Prüfbericht-Nr.: *Test report no.:*	**CN22U9PH 001**	**Auftrags-Nr.:** *Order no.*:	**244447943**	
Kunden-Referenz-Nr.: *Client reference no.:*	**2104110**	**Auftragsdatum:** *Order date:*	2022-09-06	
Auftraggeber: *Client:*	AISWEI Technology (Shanghai) Co., Ltd. Room 905B, 757 Mengzi Road, Huangpu District, Shanghai			
Prüfgegenstand: *Test item:*	PV Inverter			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	ASW110K-LT, ASW100K-LT, ASW80K-LT, ASW75K-LT			
Auftrags-Inhalt: *Order content*:	TÜV mark approval			
Prüfgrundlage: *Test specification:*	EN 62109-1: 2010, IEC 62109-2: 2011 IEC 62109-1: 2010, EN 62109-2: 2011			

Wareneingangsdatum: *Date of sample receipt:*	2022-09-26
Prüfmuster-Nr.: *Test sample no:*	A003380300-001
Prüfzeitraum: *Testing period:*	2022-09-27 - 2022-11-23
Ort der Prüfung: *Place of testing:*	TÜV Rheinland (Shanghai) Co.,Ltd.
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shanghai) Co.,Ltd.
Prüfergebnis*: *Test result*:*	Pass

geprüft von: *tested by:*	Sean Ke	**genehmigt von:** *authorized by:*	Yin Yue
Datum: *Date:* 2022-12-09	Sean Ke / PE	**Ausstellungsdatum:** *Issue date:* 2022-12-09	Yin Yue / Reviewer
Stellung / *Position:*	Sachverständige(r)/Expert	**Stellung** / *Position:*	Sachverständige(r)/Expert

Sonstiges / *Other:*

The test report includes the following documents:
- IEC/EN 62109-2 test report
- List of critical components
- Photo document

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* *Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Test Report issued under the responsibility of:

TÜVRheinland®

TEST REPORT
IEC 62109-1
Safety of Power Converter for use in Photovoltaic Power Systems
Part 1: General requirements

Report		
Report Reference No.....	:	CN22U9PH 001
Date of issue.....	:	See cover page
Total number of pages	:	See cover page
Testing Laboratory.....	:	**TÜV Rheinland (Shanghai) Co., Ltd.**
Address.....	:	No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P. R. China
Applicant's name	:	**AISWEI Technology Co., Ltd.**
Address.....	:	Room 905B, 757 Mengzi Road, Huangpu District, Shanghai
Test specification		
Standard	:	IEC 62109-1: 2010 (First Edition)
Test procedure.....	:	TÜV mark approval
Non-standard test method…..……..:		N/A
Test Report Form No.....	:	IEC62109_1B
TRF Originator	:	VDE Testing and Certification Institute
Master TRF.....	:	Dated 2016-04

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description.....	:	Grid-connected PV Inverter
Trade Mark	:	Solplanet
Manufacturer.....	:	Same as the applicant
Model/Type reference.....	:	See coverpage
Ratings.....	:	See copy of marking label and model list.

Testing procedure and testing location:
☒ Testing Laboratory: Testing location/ address..... : See cover page ☐ Associated Laboratory: Testing location/ address..... : Tested by (name + signature) ..... : Approved by (+ signature)..... :
☐ Testing procedure: TMP Testing location/ address..... : Tested by (name + signature) ..... : Approved by (+ signature)..... :
☐ Testing procedure: WMT Testing location/ address..... : Tested by (name + signature) ..... : Witnessed by (+ signature)..... : Approved by (+ signature)..... :
☐ Testing procedure: SMT Testing location/ address..... : Tested by (name + signature) ..... : Approved by (+ signature)..... : Supervised by (+ signature)..... :
☐ Testing procedure: RMT Testing location/ address..... : Tested by (name + signature) ..... : Approved by (+ signature)..... : Supervised by (+ signature)..... :

List of Attachments (including a total number of pages in each attachment):

- ATTACHMENT 1 – Test report of IEC 62109-2: 2011 (1st Edition) (15 pages)
- ATTACHMENT 2 – Photo documentation (9 pages)
- ATTACHMENT 3 – List of critical components (21 pages)

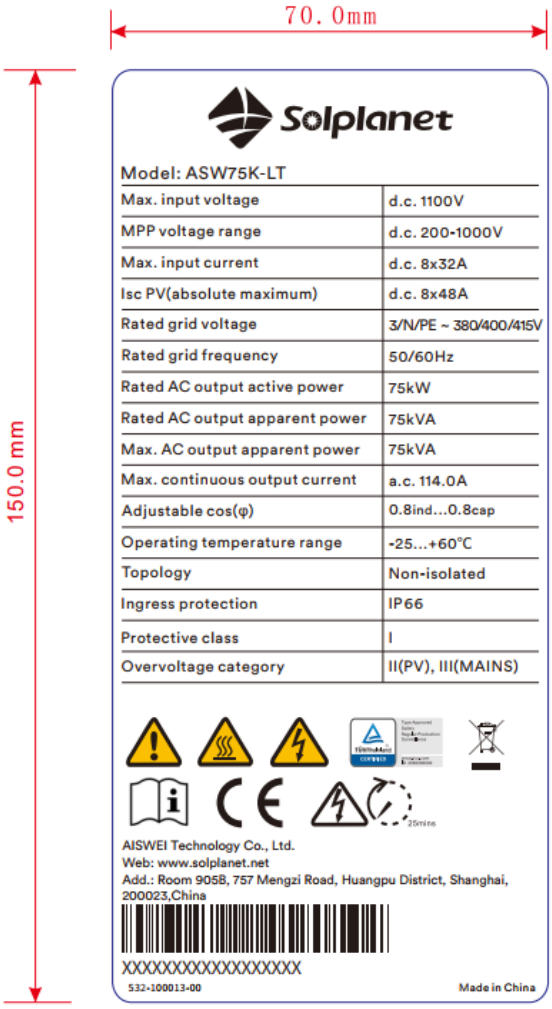
Summary of compliance with National Differences:

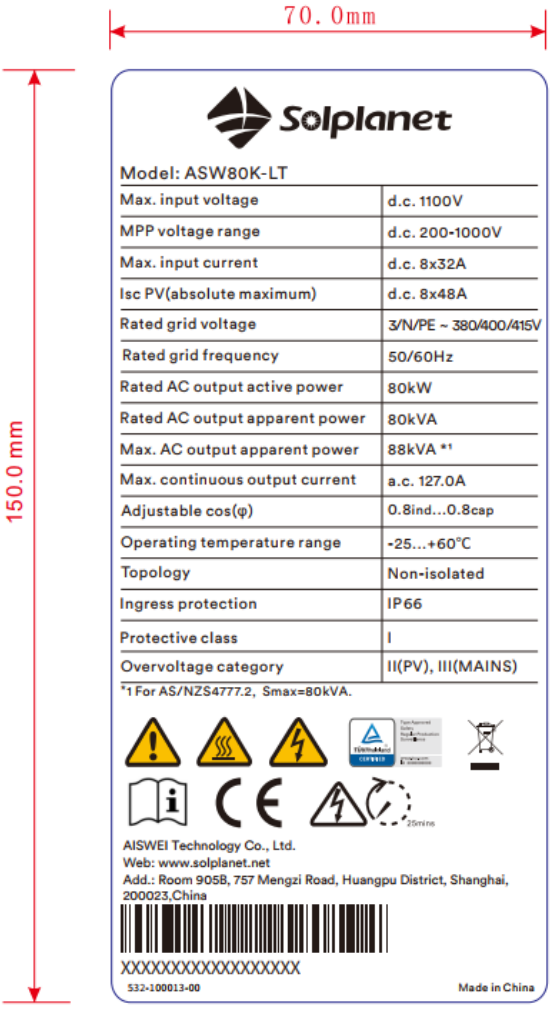
List of countries addressed: None.

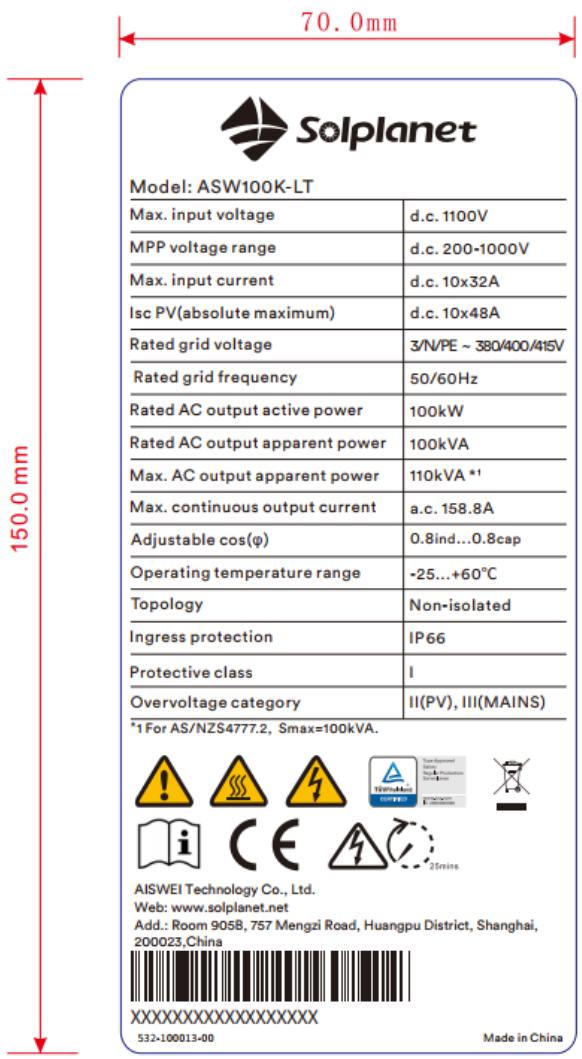
☒ The product fulfils the requirements of

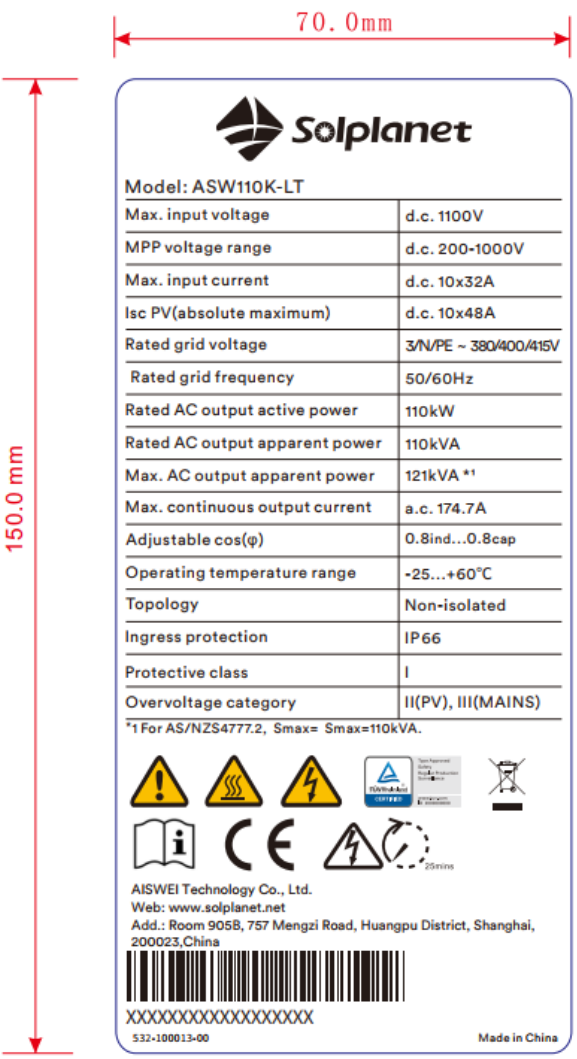
IEC 62109-1: 2010, EN 62109-1: 2010,
IEC 62109-2: 2011, EN 62109-2: 2011

Copy of marking plate:






70.0mm
150.0 mm
Solplanet
Model: ASW100K-LT
Max. input voltage d.c. 1100V
MPP voltage range d.c. 200-1000V
Max. input current d.c. 10x32A
Isc PV(absolute maximum) d.c. 10x48A
Rated grid voltage 3/N/PE ~ 380/400/415V
Rated grid frequency 50/60Hz
Rated AC output active power 100kW
Rated AC output apparent power 100kVA
Max. AC output apparent power 110kVA *1
Max. continuous output current a.c. 158.8A
Adjustable cos(φ) 0.8ind...0.8cap
Operating temperature range -25...+60℃
Topology Non-isolated
Ingress protection IP66
Protective class I
Overvoltage category II(PV), III(MAINS)
*1 For AS/NZS4777.2, Smax=100kVA.
AISWEI Technology Co., Ltd.
Web: www.solplanet.net
Add.: Room 905B, 757 Mengzi Road, Huangpu District, Shanghai, 200023,China
XXXXXXXXXXXXXXXXX
532-100013-00
Made in China


70.0mm
150.0 mm
Solplanet
Model: ASW110K-LT
Max. input voltage d.c. 1100V
MPP voltage range d.c. 200-1000V
Max. input current d.c. 10x32A
Isc PV(absolute maximum) d.c. 10x48A
Rated grid voltage 3/N/PE ~ 380/400/415V
Rated grid frequency 50/60Hz
Rated AC output active power 110kW
Rated AC output apparent power 110kVA
Max. AC output apparent power 121kVA *1
Max. continuous output current a.c. 174.7A
Adjustable cos(φ) 0.8ind...0.8cap
Operating temperature range -25...+60℃
Topology Non-isolated
Ingress protection IP66
Protective class I
Overvoltage category II(PV), III(MAINS)
*1 For AS/NZS4777.2, Smax= Smax=110kVA.
AISWEI Technology Co., Ltd.
Web: www.solplanet.net
Add.: Room 905B, 757 Mengzi Road, Huangpu District, Shanghai, 200023,China
XXXXXXXXXXXXXXXXX
532-100013-00
Made in China

Test item particulars	
Equipment mobility ..... :	☐ movable ☐ hand-held ☒ stationary ☐ fixed ☐ transportable ☐ for building-in
Connection to the mains ..... :	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category ..... :	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains ..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%) ..... :	According to the specified supply range.
Tested for power systems ..... :	TN
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) ..... :	See model list
Pollution degree..... :	☐ PD 1 ☒ PD 2 (Inside) ☒ PD 3 (outside)
IP protection class..... :	IP66
Testing	
Date of receipt of test item(s)..... :	See cover page
Dates tests performed ..... :	See cover page
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement..... :	Pass (P)
- test object was not evaluated for the requirement.. :	N/E
- test object does not meet the requirement..... :	Fail (F)

General remarks:

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Determination of the test results includes consideration of measurement uncertainty from the test equipment and methods.

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:

☐ Yes
☒ Not applicable

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies):

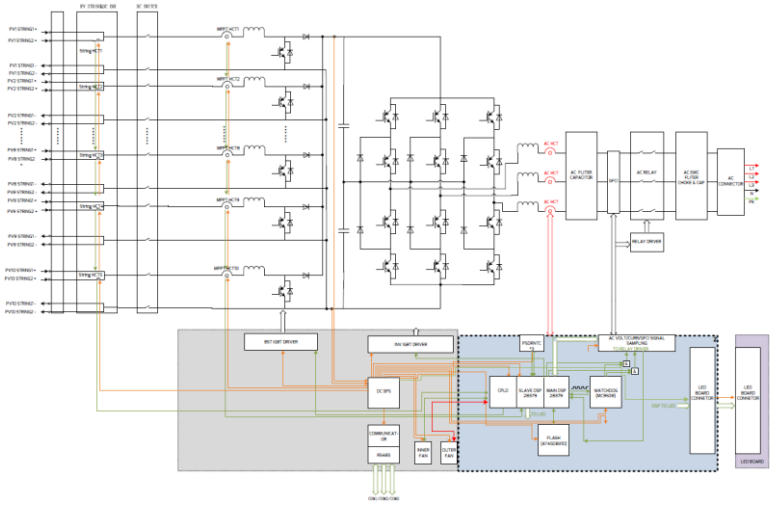
AISWEI New Energy Technology (Yangzhong) Co., Ltd.
No.588, Gangxing Road, Economic Development Zone, Yangzhong, P. R. China.

General product information:

Brief description:

The PCE under test (EUT) is Grid-connected PV inverter, which utilizes the advanced power electronics conversion components such as MOSFET, IGBT, IPM to convert the variable DC power generated from the photovoltaic (PV) arrays to the stable utility AC power, which can be fed into the commercial electrical grid.

The PCE series under test is three-phase grid-connected PV inverter for solar power generation with the rating of 75kW, 80kW, 100kW and 110kW.



Block diagram

Model difference:

The models of ASW110K-LT series are identical on topological schematic circuit diagram and control solution codes except for the type designation and the input/output rating, limited the output power only by software for each model. They are designed differently by power requirement, such as IGBT number and inductors value. See next table for details.

Difference			
Component	Type	ASW 75K-LT ASW 80K-LT	ASW 100K-LT ASW 110K-LT
PV connector	PV-FT-C2M-HSG	8*2	10*2
PV connector	PV-FT-C2F-HSG	8*2	10*2
DC switch	GHX5-32P/6P1100-32	2	2
DC switch	GHX5-32P/4P1100-32	1	2
IGBT	MPBQ75N120BF	8	10
Diode	SDS120J040H2	8	10
BOOST inductor	TRDK3J3383-2-30-85-L1	1	1
	TRDK3J3383-2-30-85-L2	1	1
	TRDK3J3383-2-30-85-L3	1	1
	TRDK3J3383-2-30-85-L4	1	1
	TRDK3J3383-2-30-85-L5	1	1
	TRDK3J3383-2-30-85-L6	1	1
	TRDK3J3383-2-30-85-L7	1	1
	TRDK3J3383-2-30-85-L8	1	1
	TRDK3J3383-2-30-85-L9	0	1
	TRDK3J3383-2-30-85-L10	0	1

Throughout the test report following abbreviations may be used:

- cl clearance
- dcr creepage distance
- dti distance through insulation
- BI basic insulation
- DI double insulation
- s-c short-circuit
- o-c open-circuit
- o-l overload
- SI supplementary insulation
- RI reinforced insulation

Model list:

Model		ASW75K-LT	ASW80K-LT
INPUT	V_{MAXPV} [Vdc]	1100	
	I_{SCPV} [A]	8*48	
	MPP Voltage Range [Vdc]	200 - 1000	
	Full power MPP Voltage Range [Vdc]	460 - 850	
	Max. Input Current [A]	8*32	
	Start PV Voltage [Vdc]	250	
	Back feed Current [A]	0	
	Overvoltage Category (OVC)	II	
OUTPUT	Rated Output Voltage [Vac]	220 V / 380 V 230 V / 400 V	
	Rated Output Frequency [Hz]	50/60	
	Rated Output Power [kW]	75	80
	Max. Apparent Power [kVA]	75	88
	Max. Output Current [A]	114.0	127.0
	Power Factor (cosφ)	1.0 (default), 0.80 lead, 0.80 lag	
	Overvoltage Category (OVC)	III	
SYSTEM	Protective Class	I	
	Enclosure Protection (IP)	IP66	
	Operating Temperature Range [ºC]	-25 to 60(>40 derating)	
	Pollution Degree (PD)	PD 3	
	Altitude [m]	≤ 3000	
	Acoustic Noise [dB]	≤ 65	
	Weight [kg]	85	
	Size (W x H x D) [mm]	984 *640 * 330	
	Firmware Version	Main DSP Software version: V610-04001-00 Slave DSP Software version: V610-04002-00	
	Software Version	Safety package (Flash) version: V610-12001-00	

Model list:

Model		ASW100K-LT	ASW110K-LT
INPUT	V_{MAXPV} [Vdc]	1100	
	I_{SCPV} [A]	10*48	
	MPP Voltage Range [Vdc]	200 - 1000	
	Full power MPP Voltage Range [Vdc]	460 - 850	
	Max. Input Current [A]	10*32	
	Start PV Voltage [Vdc]	250	
	Back feed Current [A]	0	
	Overvoltage Category (OVC)	II	
OUTPUT	Rated Output Voltage [Vac]	220 V / 380 V 230 V / 400 V	
	Rated Output Frequency [Hz]	50/60	
	Rated Output Power [kW]	100	110
	Max. Apparent Power [kVA]	110	121
	Max. Output Current [A]	158.8	174.7
	Power Factor (cosφ)	1.0 (default), 0.80 lead, 0.80 lag	
	Overvoltage Category (OVC)	III	
SYSTEM	Protective Class	I	
	Enclosure Protection (IP)	IP66	
	Operating Temperature Range [ºC]	-25 to 60(>40 derating)	
	Pollution Degree (PD)	PD 3	
	Altitude [m]	≤ 3000	
	Acoustic Noise [dB]	≤ 60	
	Weight [kg]	85	
	Size (W x H x D) [mm]	984 *640 * 330	
	Firmware Version	Main DSP Software version: V610-04001-00 Slave DSP Software version: V610-04002-00	
	Software Version	Safety package (Flash) version: V610-12001-00	

Throughout the test report following abbreviations may be used:

- input	i/p	- Test repeated, similar result(3 times)	TRSR
- output	o/p	- No indication of dielectric breakdown	NB
- short-circuited	s-c	- Cheesecloth remained intact	NC
- overloaded	o-l	- Tissue paper remained intact	NT
- open-circuited	o-c	- No hazards	NH
- normal conditions	N.C.	- The PCE can recover to operate automaticly after removing the abnormal condition	RO
- single fault conditions	SFC	- functional insulation	FI
- between parts of opposite polarity	BOP	- basic insulation	BI
- internal protection operated	IPO	- supplementary insulation	SI
- Component damage (list damaged component)	CD	- double insulation	DI
- No component damaged	NCD	- reinforced insulation	RI

Indicate used abbreviations (if any)

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

4	**GENERAL REQUIREMENTS**		**P**
4.1	General General Testing is required by this standard to demonstrate that the EUT is fully in accordance with the applicable requirements of this standard.		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Unless otherwise specified in this standard, for example with regard to environmental category as defined in 6.1, the following ambient environmental conditions shall exist in the test location: a) temperature of 15 °C to 40 °C; b) a relative humidity of not more than 75 % and not less than 5 %; c) an air pressure of 75 kPa to 106 kPa; d) no frost, dew, percolating water, rain, solar radiation, etc.	Ambient environmental condition compliance.	P
4.2.2.2	State of equipment	Test carried on a complete EUT.	P
4.2.2.3	Position of equipment	The equipment was installed in accordance with the manufacturer's instructions.	P
4.2.2.4	Accessories	Accessories and operator-interchangeable parts available from or recommended by the manufacturer according to the installation manual required.	P
4.2.2.5	Covers and removable parts	No covers or parts, which can be removed without using a TOOL.	N/A
4.2.2.6	Mains supply	See below.	P
	a) Voltage:	A wider range is given in the specification of the EUT. DC Input: V_{MAXPV}: 1100Vd.c. AC Output: Tolerance is considered.	P
	b) Frequency:	DC Input: N/A AC Output: 50/60Hz.	P
	c) Polarity:	Permanently connected equipment.	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	d) Earthing:	Equipment was supplied from either an earthed supply system under tests.	P
	e) Over-current Protection:	Input over current protection that will be present in the installation was provided during testing.	P
4.2.2.7	Supply ports other than the mains	See below.	P
4.2.2.7.1	Photovoltaic supply sources	DC power supply source was used with sufficient capability.	P
4.2.2.7.2	Battery inputs	Not used.	N/A
4.2.2.8	Conditions of loading for output ports	The least favorable loading conditions were considered.	P
	- for continuous operation.	Until steady condition was established.	P
	- for intermittent operation.		N/A
	- for short-time operation.		N/A
4.2.2.9	Earthing terminals	Connection to the earth	P
4.2.2.10	Controls	Any position was set.	P
4.2.2.11	Available short circuit current	Considered.	P
4.3	Thermal Testing	See below.	P
4.3.1	General		P
4.3.2	Maximum temperatures Materials and components shall be selected so that under the most serve rated operating conditions, the temperatures do not exceed the temperature limits.	See appended table 4.3.	P
4.3.2.1	General		P
4.3.2.2	Touch temperatures		P
4.3.2.3	Temperature limits for mounting surfaces		P
4.4	Testing in single fault condition	See appended table 4.4.	P
4.4.1	General		P
4.4.2	Test conditions and duration for testing under fault conditions		P
4.4.2.1	General		P
4.4.2.2	Duration of tests		P
	- automatic reset devices or circuits		N/A
	- manual reset devices or circuits		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	- non-resettable devices or circuits	One cycle and until temperatures stabilize.	P
4.4.3	Compliance after application of fault conditions		P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other HAZARDS		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	SINGLE FAULT CONDITIONS	See below.	P
4.4.4.1	Component fault tests The following faults are simulated: Short circuit or open circuit of relevant components. Short circuit or open circuit of any components or insulation where failure could adversely affect supplementary insulation or reinforced insulation. In addition, where required by Method 2 of 9.1.1, components that could result in a fire hazard are to be overloaded unless they comply with the requirements of 9.1.3.	See appended table 4.4.	P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Continuous operation equipment.	N/A
4.4.4.3	Motors	External fans used for heat sink.	P
4.4.4.4	Transformer short circuit tests	See appended table 4.4.	P
4.4.4.5	Output short circuit	See appended table 4.4.	P
4.4.4.6	Backfeed current test for equipment with more than one source of supply	DC mains supply source only.	N/A
4.4.4.7	Output overload	See appended table 4.4.	P
4.4.4.8	Cooling system failure	See appended table 4.4.	P
4.4.4.9	Heating devices	No heating devices used.	N/A
4.4.4.10	Safety interlock systems	No safety interlock device used.	N/A
4.4.4.11	Reverse d .c. connections	See appended table 4.4.	P
4.4.4.12	Voltage selector mismatch	No voltage selector used.	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity	See appended table 4.4.	P
4.4.4.14	PWB short-circuit test	See appended table 4.4.	P
4.5	Humidity preconditioning	See below.	P
4.5.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.5.2	Conditions	Humidity: 98%RH Temperature: 60°C Duration: 48hrs	P
4.6	Voltage Back-feed Protection	Hazardous voltage and energy was not present on the terminals, with the DC mains supply source de-energized or disconnected. In addition the symbol 13 of Table C.1 was marked for servicing functions	P
4.6.1	Back-feed tests under normal conditions	Relay or Contactor is available at AC output side to prevent back-feed current from AC to DC side.	P
4.6.2	Back-feed tests under single-fault conditions	Relay is available at AC output side and with auto disconnected device at DC input side to prevent back-feed current from AC to DC side, even if under single-fault conditions.	P
4.6.3	Compliance with back-feed tests	See above.	N/A
	- 15 s for sources that are connected by fixed wiring		N/A
	- 1 s for sources that are cord-connected or use connectors that can be opened without the use of a tool		N/A
4.7	Electrical Ratings Tests	See appended table 4.7.	P
4.7.1	Input Ratings		P
4.7.2	Output Ratings		P

5	**MARKING AND DOCUMENTATION**		**P**
5.1	Marking		P
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2	The marking label is on the outer surface of the enclosure.	P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.	All used graphic symbols are in accordance with Annex C.	P
	Graphic symbols shall be explained in the documentation provided with the PCE.	The explanations are provided in the user manual.	P
5.1.2	Durability of markings	The labels were subjected to the permanence of marking test. The labels were rubbed	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		with the cloth soaked with petroleum spirit for 30 s.	
	Markings required by this clause to be located on the PCE shall remain clear and legible under conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer	After this test there was no damage to the labels. The marking on the labels did not fade. There was no curling or lifting of the label's edges.	P
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:	See below.	
	a) the name or trade mark of the manufacturer or supplier	See copy of marking plate.	P
	b) model number, name or other means to identify the equipment	See above.	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	See above.	P
5.1.4	Equipment ratings		P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	See below	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	See model list.	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	See above.	P
	– the ingress protection (IP) rating as in 6.3 below	See clause 6.3	P
5.1.5	Fuse identification		P
	Marking shall be located adjacent to each fuse or fuse holder, or on the fuse holder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.	Marking on PCB near fuses.	P
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated	See above.	P
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the	See above.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	servicing instructions which shall contain the relevant information.		
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.	Relevant symbol, indicator or information are available.	P
	Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action shall be colored red.	No such device.	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other nonpermanent material.		N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign “+“ for positive and “-“ for negative; or	The “+” and “-“ marking provided adjacent to the PV input connectors.	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	No pictorial representation illustration used.	N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing conductor shall be marked with:		P
	– symbol 7 of Annex C; or	Symbol 7 of Table C.1 marked adjacent to the PE terminal.	P
	– the letters “PE“; or	See above.	N/A
	– the color coding green-yellow.		P
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	The letter “ON” and “OFF” is clearly marked.	P
5.1.8	Class II Equipment	Class I Equipment.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.	See above.	N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C	See above.	N/A
5.1.9	Terminal boxes for External Connections		N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:	Not used.	N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings		P
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high		P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in color with the background		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in color from the background, shall have a depth or raised height of at least 0,5 mm.	No such symbols.	N/A
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C		P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heatsinks and similar parts		P

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Clause	Requirement – Test	Result – Remark	Verdict
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heatsink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heatsink exists.	Marked with symbol 13 of Table C.1.	P
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	Marked with symbol 14 of Table C.1.	P
5.2.2.3	Coolant		N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:	Not used.	N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	Marked with Symbol 21 of Table C.1 and the time to discharge capacitors to safe voltage and energy levels accompany the symbol.	P
5.2.2.5	Motor guarding		N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).		N/A
5.2.3	Sonic hazard markings and instructions	No such hazard.	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can enxure that the sound pressure level from equipment at its point of use after installation, will not reach a		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		
5.2.4	Equipment with multiple sources of supply		P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	Marked with symbol 13 of Annex C and explain in user manual.	P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.	See above.	P
5.2.5	Excessive touch current		P
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	The caution symbol 15 of Table C.1 provided on PCE and the information provided in manual.	P
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:	All related informations provided in the user's maunal.	P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1		P
	– WET LOCATIONS classification fort he intended external environment as per 6.1		P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2		P
	– INGRESS PROTECTION rating as per 6.3		P
	– Ambient temperature and relative humidity ratings		P
	– MAXIMUM altitude rating		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;		P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE		P
5.3.1.1	Language		P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	Instruction related to safety is in English.	P
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	The printed form is available and is delivered with the PCE.	P
	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.	See above.	N/A
5.3.2	Information related to installation		P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:	All below related informations provided in the user's maunal.	P
	a) assembly, location, and mounting requirements:		P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, color coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	f) requirements for special services, for example cooling liquid;		N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;	No hazardous sound level.	P
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;	No battery used in the PCE.	P
	i) tightening torque to be applied to wiring terminals;		P
	j) values of back-feed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceeds the max. rated current of the circuit, as per 4.4.4.6;	No backfeed current available.	P
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and		P
	l) compatibility with RCD and RCM;	RCMU built in PCE.	P
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:		P
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		P
	"This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product."		P
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	The PCE is grid connected, no battery used.	P
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		P
5.3.3	Information related to operation		P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:	All related information provided in the user's maunal.	P
	– Instructions for adjustment of controls including		P

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Clause	Requirement – Test	Result – Remark	Verdict
	the effects of adjustment;		
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		P
	– Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.		P
5.3.4	Information related to maintenance		P
	Maintenance instructions shall include the following:	All related information provided in the service maunal.	
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		P
	– Part numbers and instructions for obtaining any required operator replaceable parts;		P
	– Instructions for safe cleaning (if recommended)		P
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
5.3.4.1	Battery maintenance		N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:	The PCE is Grid Interactive inverter without battery energy storage function.	N/A
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		**P**
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below		P
	– Suitability for WET LOCATIONS or not		P
	– POLLUTION DEGREE rating in 6.2 below		P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below		P
	– Ultraviolet (UV) exposure rating, as in 6.4 below		P
	– Ambient temperature and relative humidity ratings, as in 6.5 below		P
6.1	Environmental categories and minimum environmental conditions	See below.	P

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Clause	Requirement – Test	Result – Remark	Verdict
6.1.1	Outdoor	For outdoor use.	P
6.1.2	Indoor, unconditioned	See above.	N/A
6.1.3	Indoor, conditioned	See above.	N/A
6.2	Pollution degree	PD 2 (inside) PD 3 (outside)	P
6.3	Ingress Protection	IP66.	P
6.4	UV exposure	The shelter is considered necessary for outdoor use. Anti-UV approved AC and DC connectors provided.	P
6.5	Temperature and humidity	-25 ºC~+60 ºC 100%RH	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		**P**
7.1	General	The proper construction of PCE is available for protection against shock and energy hazards during installation, operation and maintenance under normal and single fault conditions.	P
7.2	Fault conditions	See subclause 4.4.	P
7.3	Protection against electric shock		P
7.3.1	General	Each circuit under evaluation is compliance.	P
7.3.2	Decisive voltage classification		P
7.3.2.1	Use of decisive voltage class (DVC)	See below	P
7.3.2.2	Limits of DVC (according table 6)	See subclause 7.3.2.1.	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)	For circuits evaluation information of PCE, refer to brief description of general product information on previous pages.	P
7.3.2.5	Connection to PELV and SELV circuits	DVC-A is classified for display and communication circuits.	P
7.3.2.6	Working voltage and DVC	See subclause 7.3.2.4.	P
7.3.2.6.1	General	See above.	P
7.3.2.6.2	AC working voltage (see Figure 2)		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.2.6.3	DC working voltage (see Figure 3)		P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	Protective separation	For protective separation evaluation information of PCE, refer to brief description of general product information on previous pages.	P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or		P
	▪ protective screening, i.e. by a conductive screen connected to earth by protective bonding in the PCE, or connected to the protective earth conductor itself, whereby the screen is separated from live parts by at least basic insulation, or		P
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or		N/A
	▪ limitation of voltage according to 7.3.5.4.		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact	Protection against electic shock by means of earthed metal enclosure. Any access to touch live parts is impossible.	P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	See subclause 7.3.2.4.	P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.		N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers	Protection against electic shock by means of earthed	P

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Clause	Requirement – Test	Result – Remark	Verdict
		metal enclosure.	
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).		P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6		N/A
7.3.4.2.2	Access probe criteria	Considered.	P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Considered.	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	No DVC-B in the PCE	N/A
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	Considered.	P
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and	Live parts are enclosed by the earthed metal enclosure and no openings.	P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavorable position.	It is not possible to touch the hazardous live parts by the test finger and test pin.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.	Not intended for built-in or rack mounting.	N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.	No openings.	N/A
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.	No openings.	N/A
7.3.4.2.4	Service access areas	It is not allowed to remove the cover during installation and maintenance when PCE is energized.	P
7.3.4.3	Protection by means of insulation of live parts	See subclause 7.3.2, 7.3.3 and 7.3.4.1.	P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		
7.3.5	Protection in case of direct contact		P
7.3.5.1	General	See below.	P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or	Only DCV-A classified circuit can be touched directly, see	P

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Clause	Requirement – Test	Result – Remark	Verdict
		also 7.3.5.2.	
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with protective separation. This applies for example to plug-in-sub-assemblies or other plug-in devices which can be plugged-in without the use of a tool (key) or which are accessible without the use of a tool.		P
	Conformity is checked by visual inspection and trial insertion.		P
7.3.5.2	Protection using decisive voltage class A	Comm. port is considerd as DVC-A which can be accessible and separated from DVC-C by double or reinforced insulaiton.	P
7.3.5.3	Protection by means of protective impedance	This method not considered.	N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		N/A
7.3.5.3.1	Limitation of current through protective impedance		N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		N/A
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A
7.3.5.4	Protection by means of limited voltages	This method not considered.	N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)	The PCE is defined as protective class I.	P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	The earthing metal enclosure is complied with Protective class I.	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	The circuit of communication is complied with Protective class II for accessible communication ports.	P
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.		P
7.3.6.2	Insulation between live parts and accessible conductive parts	See subclaus 7.3.2.3, 7.3.7.4 and 7.3.7.5.	P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5	The clearances specified in 7.3.7.4 and creepage specified in 7.3.7.5 are complied.	P
7.3.6.3	Protective class I – Protective bonding and earthing		P
7.3.6.3.1	General		P
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible	Suitable protective bonding provided.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:		
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or	DVC-A classified circuit is considered.	P
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.	Communication circuits are separated from live parts used double or reinforced insulation.	P
7.3.6.3.2	Requirements for protective bonding	The cross-section of the protective bonding conductor is the same as that for the external protective earthing conductor.	P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;	The connection of external protective earthing conductor is direct metal contact via a terminal with screw.	P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		P
	c) through a dedicated protective bonding conductor;	Protective earthing terminal used.	P
	d) through other metallic components of the PCE		N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.		P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.		N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.		P
7.3.6.3.3	Rating of protective bonding	See below.	P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to	Suitable protective bonding used.	P

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	a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		
	Protective bonding shall meet following requirements:	See below.	P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.	Sub clause 7.3.6.3.5 is considered.	N/A
	As alternative to a) and b) the protective bonding may designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.	The cross-section of the protective bonding conductor is the same as that for the external protective earthing conductor.	P
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		N/A
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		N/A
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but		N/A

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	the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.		
	On equipment where the protective earth conncection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cab le is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		N/A
7.3.6.3.3.1	Test current, duration, and acceptance criteria	The alternative of sub clause 7.3.6.3.5 was considered.	N/A
	The test current, duration of the test and acceptance criteria are as follows:		N/A
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		N/A
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		N/A
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		N/A
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	characteristic,. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		
7.3.6.3.4	Protective bonding impedance (routine test)		N/A
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:	The alternative of sub clause 7.3.6.3.5 was considered.	N/A
	▪ the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:		N/A
	▪ the test duration may be reduced to no less than 2 s		N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor		P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.	Grounding cable cross-section: 16 mm² at least	P
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		P
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	▪ 2,5 mm² if mechanical protection is provided;		N/A
	▪ 4 mm² if mechanical protection is not provided.		P
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	strain-relief mechanism, be the last conductor to be interrupted.		
7.3.6.3.6	Means of connection for the external protective earthing conductor		P
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.	The external protective earthing terminal block consist of other live conducts as AC connector for connecting PCE to the mains. Corrosion-resistant is considered for connection and bonding points. Separated earthing terminal be provided for protective earthing conductor was specified in user manual.	P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or	With the symbol 7 of Table C.1.	P
	• the colour coding green-yellow	The color coding of Green – yellow recommended.	P
	Marking shall not be done on easily changeable parts such as screws.		P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.		N/A
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	In addition, the caution symbol 15 of Table C.1 provided on PCE and in manual.	P
	a) Permanently connected wiring, and:		P

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	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or		P
	• automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		N/A
	• provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		P
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	PCE is designed for protective class I.	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		N/A
	• equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	voltage, protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment;		
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.		N/A
7.3.7	Insulation Including Clearance and Creepage Distance	See below.	P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	• pollution degree	See sub clause 7.3.7.1.1.	P
	• overvoltage category	See sub clause 7.3.7.1.2.	P
	• supply earthing system	See sub clause 7.3.7.1.3.	P
	• insulation voltage	See sub clause 7.3.7.1.4.	P
	• location of insulation		P
	• type of insulation		P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.		
7.3.7.1.1	Pollution degree	PD 2 (inside), PD 3 (outside)	P
7.3.7.1.2	Overvoltage category and Impulse withstand voltage rating ..... :		P
	- MAINS circuits	O.V.C III	P
	- PV circuits insulated	O.V.C II	P
	- PV circuits not insulated	No such circuits.	N/A
	- Other circuits	O.V.C II	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.1.3	Supply earthing systems		P
	Three basic types of earthing system are described in IEC 60364-1. They are:		P
	• TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P
	• TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		N/A
	• IT sytem: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		N/A
7.3.7.1.4	Insulation voltages	PV supply circuits impluse voltage: 4772V ($V_{MAX\ PV}$: 1100Vd.c.) AC mains circuits impluse voltage:: 4000V (Rated: 3N~ 400Va.c.)	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstand voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General	Considered.	P
7.3.7.2.2	Circuits connected directly to the MAINS	Clearances and solid insulation required according to the impulse voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement.	P
7.3.7.2.3	Circuits other than MAINS circuits	Clearances and solid insulation required according to the impulse voltage and recurring peak voltage.	P
7.3.7.2.4	Insulation between circuits	Clearances and solid insulation according to the higher impulse voltages. Creepages according ot the higher r.m.s. working voltage.	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.3	Functional insulation		P
7.3.7.4	Clearance distances	See appended table 7.3.7.4.	P
7.3.7.4.1	Determination	The max. insulation / implulse voltage: 4772V.	P
7.3.7.4.2	Electric field homogeneity	Not considered.	N/A
7.3.7.4.3	Clearance to conductive enclosures	Refer to subclause 7.3.7.4.1 and 13.7.	P
7.3.7.5	Creepage distances	See appended table 7.3.7.5.	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage	The max. voltage: 400Vrms / 1100Vd.c	P
7.3.7.5.3	Materials	Insulating material group IIIa CTI ≥ 175 assumed.	P
7.3.7.6	Coating	Not used.	N/A
7.3.7.7	PWB spacings for functional insulation	Comply with 7.3.7.4 and 7.3.7.5.	N/A
7.3.7.8	Solid insulation		P
7.3.7.8.1	General		P
7.3.7.8.2	Requirements for electrical withstand capability		P
7.3.7.8.2.1	Basic, supplemental, reinforced, and double insulation	Passed the impulse withstand voltage and a.c. or d.c. voltage tests. See appended table 7.5.1, 7.5.2 & 7.5.3. Note: No double or reinforced solid insulation used. No voltage stress on the insulation is greater than 1 kV/mm.	P
7.3.7.8.2.2	Functional insulation	Not used.	N/A
7.3.7.8.3	Thin sheet or tape material	See below.	P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0.2 mm^2	Bobbin used in power trans-former.	P
	Basic or supplementary insulation shall consist of at least one layer of material, and shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic or supplementary insulation.	See appended table 7.5.1, 7.5.2 & 7.5.3.	P
	Double insulation shall consist of at least two layers of material. Each layer shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic insulation, and the partial	Not used.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	discharge requirements of 7.3.7.8.2.1. The two or more layers together shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for double insulation.		
	Reinforced insulation shall consist of a single layer of material, which will meet the impulse, a.c. or d.c. voltage, and partial discharge test requirements 7.3.7.8.2.1 for reinforced insulation.	Not used.	N/A
7.3.7.8.3.3	Material thickness less than 0.2 mm ^{2} .	More than 3 layers mylar sheets provided between primary and secondry in main transformer.	P
	Basic or supplementary insulation shall consist of at least one layer of material, and shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic or supplementary insulation.	See appended table 7.5.1, 7.5.2 & 7.5.3.	P
	Double insulation shall consist of at least three layers of material. Each layer shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic insulation any two layers together shall meet the impulse, a.c. or d.c. voltage, and partial discharge test requirements of 7.3.7.8.2.1 for double insulation.	Not used.	N/A
	Reinforced insulation consisting of a single layer of material less than 0,2 mm thick is not permitted.	Not used.	N/A
7.3.7.8.3.4	Compliance	See subclause 7.3.7.8.3.2.	P
7.3.7.8.4	Printed wiring boards (PWBs)		P
7.3.7.8.4.1	General	Insulation between conductor layers in double-sided single-layer PWBs meet the requirements of 7.3.7.8.1. Basic, supplementary, double and reinforced insulation meet the appropriate requirements of 7.3.7.8.2.1 or 7.3.7.8.2.2. Functional insulation in PWBs meet the requirements of 7.3.7.8.2.3.	P
7.3.7.8.4.2	Use of coating materials	No coating material used.	P
	Type 1 protection		P
	Type 2 protection		N/A
	Cold test (-25°C) and rapid change of temperature test (-25°C to +125°C)		P
7.3.7.8.5	Wound components		P
7.3.7.8.6	Potting materials		P
7.3.7.9	Insulation requirements above 30 kHz	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility	Built-in RCM unit within the PCE.	P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.	Under normal and single-fault conditions, the resulting d.c. component of the current in the protective earthing conductor does not exceed the d.c. current withstand requirements in IEC 60755 and IEC 62020 for RCD and RCM of type B.	P
7.3.9	Capacitor discharge	See appended table 7.3.9.	P
7.3.9.1	Operator access area		N/A
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.	No such operator area to access without the use of a tool.	N/A
7.3.9.2	Service access areas		P
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE.	The warning symbol 21 of Table C.1 and an indication of the discharge time is placed in a clearly visible position on the protective barrier to avoid unconsciousness contact.	P
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level	There is no risk of energy hazard in operator access areas, protection of electrical shock by means of earthed metal enclosure.	P
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$		P
7.4.2	Operator Access Areas		P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.	All hazardous energy parts were enclosed within the earthed metal enclosure.	P
7.4.3	Services Access Areas		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Energy storage devices located behind panels that are removable for servicing, installation or disconnection shall present no risk of electric energy hazard from charge stored after disconnection of the PCE.		P
	Energy storage devices within a PCE shall be discharged to an energy level less than 20 J, as in 7.4.1, within 10 s after the removal	The warning symbol 21 of Table C.1 and an indication of the discharge time is placed in a clearly visible position on the protective barrier to avoid unconsciousness contact.	P
7.5	Electrical tests related to shock hazard		P
7.5.1	Impulse voltage test (*type test*) The impulse voltage test is performed with a voltage having a 1,2/50 µs waveform (see Figure 6 of IEC 60060-1) and is intended to simulate overvoltages induced by lightning or due to switching of equipment. See Table 15 for conditions of the impulse voltage test.	See appended table 7.5.1. During the test no puncture, flashover, or sparkover occurs.	P
7.5.2	Voltage Test (dielectric strength test) (type test and routine test)	See below.	P
7.5.2.1	Purpose of test		P
7.5.2.2	Value and type of test voltage The values of the test voltage are determined from column 2 or 3 of Table 17 or Table 18 depending upon whether the circuit under test is mains connected or not mains connected.	See appended table 7.5.2.	P
7.5.2.3	Humidity pre-conditioning	PCE is inteneded for WET LOCATIONS use.	P
7.5.2.4	Performing the voltage test The test shall be applied as follows, according to Figure 13	Refer to appended table 7.5.2.	P
7.5.2.5	Duration of the a.c. or d.c. voltage test The duration of the test shall be at least 60 s for the type test and 1 s for the routine test. The test voltage may be applied with increasing and/or decreasing ramp voltage, and the ramp times are not specified, but regardless of the ramp time, the dwell time at full voltage shall be 60 s and 1 s respectively for type and routine tests.	The full voltage is maintained for 60s.	P
7.5.2.6	Verification of the a .c. or d.c. voltage test	No electrical breakdown occurs during the test.	P
7.5.3	Partial discharge test (type test or sample test)	No voltage stress on the insulation is greater than 1 kV/mm.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.		P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.5	Equipment with multiple sources of supply		N/A
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		**P**
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.	Edges, projections, corners, openings, guards, handles and the like, that are accessible to the OPERATOR are smooth and rounded.	P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		N/A
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.		N/A
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table C.1 shall be applied on or near the guard.	Barrier and the marking of symbol 15 of Table C.1 is provided for service persons.	P
8.3	Stability		N/A
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	The PCE is wall mounted equipment.	N/A
8.4	Provisions for lifting and carrying		P
	If carrying handles or grips are fitted to, or supplied		P

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Clause	Requirement – Test	Result – Remark	Verdict
	with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.		
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.		P
8.5	Wall mounting		P
	Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.	Mounting brackets and wall construction for installation condition are specified in installation manual. Mounting brackets withstand a force of four times the weight of the equipment.	P
8.6	Expelled parts		N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.	No such parts.	N/A

9	**PROTECTION AGAINST FIRE HAZARDS**		**P**
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.	Suitable and appropriate materials, components and construction are used to reduce the risk of ignition and the spread of flame.	P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.		P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.	A FIRE ENCLOSURE is required for equipment or parts of equipment.	P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		P
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and		P
	– insulated wiring, except as permitte in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure	See above.	N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.	Metal enclosure provided.	P
9.1.3.2	Materials for fire enclosures		P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.	Metal enclosure provided.	P
9.1.3.3	Materials for components and other parts outside fire enclosures		P
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.	FLAMMABILITY CLASS HB or better used.	P
9.1.3.4	Materials for components and other parts inside fire enclosures	FLAMMABILITY CLASS V- 2 or better used.	P

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Clause	Requirement – Test	Result – Remark	Verdict
9.1.3.5	Materials for air filter assemblies	No such materials.	N/A
9.1.4	Openings in fire enclosures		P
9.1.4.1	General	No openings in fire enclosures.	P
	For equipment that is intended to be used or installed in more than one orientation as specified in the product documentation, the following requirements apply in each orientation.		P
	These requirements are in addition to those in the following sections:		P
	– 7.3.4, Protection against direct contact;		P
	– 7.4, Protection against energy hazards;		P
	– 13.5, Openings in enclosures		P
9.1.4.2	Side openings treated as bottom openings	See above.	N/A
9.1.4.3	Openings in the bottom of a fire enclosure	See above.	N/A
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.		N/A
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA		N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		P
9.1.4.6	Additional requirements for openings in transportable equipment	PCE not for transportable equipment.	N/A
9.2	LIMITED POWER SOURCES	Not applied.	N/A
9.2.1	General		N/A
9.2.2	Limited power source tests		N/A
9.3	Short-circuit and overcurrent protection		P
9.3.1	General		P
	The PCE shall not present a hazard, under short-	No overcurrent hazards was	P

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Clause	Requirement – Test	Result – Remark	Verdict
	circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.	presented by short circuits and overloads tests. Refer to sub-clause 4.4.4.	
9.3.2	Number and location of overcurrent protective devices		P
	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P
9.3.3	Short-circuit co-ordination (backup protection)		P
	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.	Upstream protective device for backup protection is specified in the installation manual.	P
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		**P**
10.1	General		P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.		P
10.2	Sonic pressure and Sound level		P
10.2.1	Hazardous Noise Levels	Sound pressure level is lower than 80dB.	P
11	**PROTECTION AGAINST LIQUID HAZARDS**		**N/A**
11.1	Liquid Containment, Pressure and Leakage	No liquid contained in this system, and energy staorage battery used.	N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease		N/A
12	**CHEMICAL HAZARDS**		N/A
12.1	General	No chemical Hazards.	N/A
13	**PHYSICAL REQUIREMENTS**		**P**
13.1	Handles and manual controls	It shall not be possible to fix them in wrong position if this might result in a hazard.	P
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than selfhardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.		P
13.1.1	Adjustable controls	No such controls.	N/A
13.2	Securing of parts	Screws, nuts, washers, springs or similar parts are secured so as to withstand mechanical stresses occurring	P
13.3	Provisions for external connections		P
13.3.1	General	Appropriate provisons for external connections applied.	P
13.3.2	Connection to an a.c. Mains supply		P
13.3.2.1	General	Terminals provided for permanent connection to the PV supply.	P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		P
	– a non-detachable power supply cord for connection to the supply by means of a plug		N/A
	– an appliance inlet for connection of a detachable power supply cord; or		N/A
	– a mains plug that is part of direct plug-in equipment as in 13.3.8		N/A
13.3.2.2	Permanently connected equipment	A set of terminals as specified in 13.3.3 for external connection of supply cords.	P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord	Not provided, but technical requirements provided in user manual.	N/A
13.3.2.5	Cord anchorages and strain relief	No power supply cords provided.	N/A
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage	No power supply cords provided, however plastic inlet bushings provided ready for use.	N/A
13.3.3	Wiring terminals for connection of external conductors		P
13.3.3.1	Wiring terminals	Terminals for power supply cords connection by means of screws.	P
13.3.3.2	Screw terminals	Screws and nuts which clamp external supply conductors have a thread conforming to ISO 261 or ISO 262.	P
13.3.3.3	Wiring terminal sizes	The terminals meet the temperature rise test of 4.3 when connected using wire sizes as specified in the documentation or in Table 24.	P
13.3.3.4	Wiring terminal design	Lug terminals applied, and the cable lug clamped by nut.	P

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Clause	Requirement – Test	Result – Remark	Verdict
13.3.3.5	Grouping of wiring terminals	Terminals located in proximity to each other.	P
13.3.3.6	Stranded wire	Lug terminals applied.	P
13.3.4	Supply wiring space	Lug terminals applied, and the cable lug is clamped by nut without the risk of damage to the conductors or their insulation.	P
13.3.5	Wire bending space for wires 10 mm² and greater	Considered.	P
13.3.6	Disconnection from supply sources	Disconnect devices provided.	P
13.3.7	Connectors, plugs and sockets	The misconnection is unlikely for PV or DC connectors.	P
13.3.8	Direct plug-in equipment	Not direct plug-in use.	N/A
13.4	Internal wiring and connections		P
13.4.1	General	The insulation, conductors and routing of all wires of the equipment is suitable for the electrical, mechanical, thermal and environmental conditions of use.	P
13.4.2	Routing	Wires are routed away from sharp edges, screw threads, burrs, fins, moving parts, drawers, and similar parts, which could abrade the wire insulation.	P
13.4.3	Colour coding	The green/yellow color coding wire only used for protective earthing conductor.	P
13.4.4	Splices and connections	All splices and connections are mechanically adequate secure and provided electrical continuity. The likelihood of loose is impossible.	P
13.4.5	Interconnections between parts of the PCE	The communication cable only used for servicing, no any physical damage or mechanical damage likely.	P
13.5	Openings in enclosures	Not opening in metal enclosure.	N/A
13.5.1	Top and side openings		N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
13.6	Polymeric Materials		P
13.6.1	General	See below.	P
13.6.1.1	Thermal index or capability	Appropriate electrical, mechanical, thermal and flammability degree polymeric materials provided.	P
13.6.2	Polymers serving as enclosures or barriers prevent-ing access to hazards	Metal enclosure used.	N/A
13.6.2.1	Stress relief test	See above.	N/A
13.6.3	Polymers serving as solid insulation	See below.	P
13.6.3.1	Resistance to arcing		P
13.6.4	UV resistance	Metal enclosure provided.	N/A
	Polymeric parts of an OUTDOOR ENCLOSURE re-quired for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation		N/A
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General	See below.	P
13.7.2	250-N deflection test for metal enclosures	A steady force of 250 N applied for 5 s, after test no hazards occurred.	P
13.7.3	7-J impact test for polymeric enclosures	Impact test applied on the display screen cover.	P
13.7.4	Drop test	Not for hand - held, direct plug - in, or transportable equipment.	N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A

14	**COMPONENTS**		**P**
14.1	General	Components that are certified to IEC and /or national stand-ards are used correctly within their ratings. Components not covered by IEC standards are tested under the conditions present in the equipment. See appended table 14.1.	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS		P

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Clause	Requirement – Test	Result – Remark	Verdict
	unless a specific exception is made. They shall conform to one of the following:		
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Overtemperature Protection		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperatur HAZARD, or a fire HAZARD, shall be protected by an overtemperature or thermal protection device meeting the requirements of 14.3.		N/A
14.3	Overtemperature protection devices	Approved overtemperature protective devices used and for which appropriate rating was selected for use and do not operate in normal use. For overtemperature protection test or evaluation see appended table 4.4.4.	P
14.4	Fuse holders	Fuse holders with fuses are not intended to be replaceable by an	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
		OPERATOR.	
14.5	MAINS voltage selecting devices	No such devices.	N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.	PCB materials with a flammability classification of V-1 or better used.	P
	This requirements does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		P
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		P
14.7	Circuits or components used as transient overvoltage limiting devices		N/A
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	No such components.	N/A
14.8	Batteries		N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	Not batteries used.	N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A nonmetallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	resistant coating.		
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	**SOFTWARE AND FIRMWARE PERFORMING SAFETY FUNCTIONS**		**P**
	Firmware or software used in or with PCE, that performs one or more safety functions the failure of which could result in a risk of fire, electric shock or other hazard as specified by this standard, shall be evaluated in accordance with Annex B.	Single fault safe compliance. Failures evaluation and risk analysis were performed by means of fault simulation or single fault conditions. (refer to subclause of 4.4.4).	P
A	Annex A, Measurement of clearance and creepage distances (normative)		P
B	Annex B, Programmable Equipment (normative)		N/A
B.1	Software or Firmware That Perform Safety Critical Functions	Refer to subclause 15.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
B.1.1	All software or firmware that performs a critical safety function/s, such as protection from excessive temperature, over current or improper synchronization of AC source, where failure of which can result in a risk of fire, electric shock or other hazard as specified by this document, shall be evaluated by one of the following means. a) All software or firmware limit or control shall be disabled before the test to evaluate the hardware circuitry during the abnormal test condition of the safety function, and the hardware sensor component that is monitored by the firmware or software is modified or disabled to prevent the software or firmware from reading or responding to the abnormal condition. b) Protection Controls employing software or firmware to perform their function(s), shall be so constructed that they comply with IEC 60730-1 Annex H to address the risks identified in B2.1. Each combination of microprocessor model, manufacturer and firmware/software version used in the production of a PCE shall be evaluated as specified in the remainder of Annex B. Exception: For units with firmware/software that has been found to be compliant with the remainder of Annex B, subsequent firmware/software revisions may be entitled to a limited revaluation for the revised firmware or software. The scope of the re-evaluation shall be defined by the potential impact of the firmware or software revisions and the applicable portions of IEC 60730-1 Annex H shall be re-applied.		N/A
B.2	Evaluation of Controls Employing Software	Refer to subclause 15.	N/A
B.2.1	Risk Analysis		N/A
B.2.1.1	A risk analysis shall be conducted to determine a set of risks and that the software addresses the identified risks. The risk analysis shall be conducted based on the safety requirements for the programmable component.		N/A
B.2.1.3	An analysis shall be conducted to identify the critical, non-critical, and supervisory parts of the software.		N/A
B.2.1.4	An analysis shall be conducted to identify transitions or states that can result in a risk.		N/A
B.2.1.5	Risks to be considered include, but are not limited to function associated with the following: a) Temperature control, monitoring and response (ie. Coolant, internal ambient, device) b) Safety interlocks c) Synchronization between multiple AC sources		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	e) Emergency stop of operation (including staged shutdown/sequencing) f) Connection/Disconnection – from an input source and output source g) RCD functions h) Over current protection or control i) The software must detect a hardware or software malfunction and place the device in a safe state as indicated per the “Risks Addressed State” definition.		
C.	Annex C, Symbols to be used in Equipment Marking (normative)		P
D.	Annex D, Test Probes for Determining Access (informative)		P
E.	Annex E, RCDs (informative)		N/A
E.1	Selection of RCD type in AC circuits		N/A
F.	Annex F, Altitude correction for clearances (informative)		P
G.	Annex G, Clearance and creepage distance determination for frequencies greater than 30kHz		N/A
G.1	Clearance		N/A
G.2	Creepage distance		N/A
H.	Annex J, Measuring Instrument for Touch Current Measurements		P
H.1	Measuring instrument	Considered.	P
H.2	Alternative measuring instrument	Not used.	N/A
I.	Annex K, Examples of Protection, Insulation and Overvoltage Category Requirements for PCE		P
I.1	Protection, Insulation and Overvoltage	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.6 / 4.7	TABLE: electrical data in normal condition	P

ASW75K-LT

P/P_n [%]	PV / DC Input				Grid / AC Output				Test condition
	I/P Imax [A]	U [V]	I [A]	P [W]	O/P Imax [A]	U [V]	I [A]	P [W]	
100	8*32	853.36	90.67	77377.58	114.0	230.52	109.32	75572.02	A
100	8*32	630.9	122.09	77018.92	114.0	230.88	109.05	75339.92	B
100	8*32	459.23	169.01	77423.04	114.0	230.52	109.07	75356.59	C

ASW80K-LT

P/P_n [%]	PV / DC Input				Grid / AC Output				Test condition
	I/P Imax [A]	U [V]	I [A]	P [W]	O/P Imax [A]	U [V]	I [A]	P [W]	
100	8*32	854.68	96.7	82649.05	127.0	230.94	116.71	80703.24	A
100	8*32	630.8	129.95	81933.13	127.0	230.57	116.03	80172.72	B
100	8*32	459.64	180.78	82898.73	127.0	230.57	116.71	80647.57	C

ASW100K-LT

P/P_n [%]	PV / DC Input				Grid / AC Output				Test condition
	I/P Imax [A]	U [V]	I [A]	P [W]	O/P Imax [A]	U [V]	I [A]	P [W]	
100	10*32	856.75	120.1	102894.64	158.8	230.75	145	100278.61	A
100	10*32	625.38	163.87	102473.29	158.8	230.75	144.722	100122.29	B
100	10*32	465.59	221.56	103008.13	158.8	230.71	144.84	100198.79	C

ASW110K-LT

P/P_n [%]	PV / DC Input				Grid / AC Output				Test condition
	I/P Imax [A]	U [V]	I [A]	P [W]	O/P Imax [A]	U [V]	I [A]	P [W]	
100	10*32	854.39	132.76	113436.25	174.7	230.84	159.74	110510.93	A

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Clause	Requirement – Test	Result – Remark	Verdict

100	10*32	632.73	178.69	113057.57	174.7	232.81	159.53	110399.08	B
100	10*32	464.72	244.56	113504.93	174.7	230.85	159.12	110143.12	C

Note(s):
Test conditions:
A. I/P: V_{MPP} max=850Vd.c., O/P: Ur=230Va.c.
B. I/P: V_{MPP} nom=630Vd.c., O/P: Ur=230Va.c.
C. I/P: V_{MPP} min =460Vd.c., O/P: Ur=230Va.c.

4.3	TABLE: Thermal testing (ASW110K-LT)		P
	test voltage (V) .....:	See below	—
	t1 (°C) .....:	--	—
	t2 (°C) .....:	--	—

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
Ambient	60.0	42.0	60.0	44.0	--
BOOST1 transistor D100	77.44	69.16	84.87	82.87	130
BOOST1 transistor Q100	79.53	70.65	89.65	89.61	130
BUS film capacitor C165 and C166 cavity	81.69	81.39	83.67	85.96	105
Inverter Snubber capacitor C158 and C169 cavity	83.43	85.28	84.89	87.59	110
V-phase T1 tube driving re-sistance	92.32	98.05	92.02	97.77	130
W-phase BUSN copper foil	83.13	78.28	83.77	81.64	130
C152 INV side shell tem-perature	81.36	79.79	82.57	83.36	105
Inverter Snubber capacitor C167	83.61	84.84	84.50	86.70	110
DC SWITCH HOUSING	77.20	71.48	80.09	79.12	85
BOOST driver chip U104	79.23	75.08	83.94	85.27	125
Electrolytic capacitor C173 at BOOST side	77.57	71.58	80.45	78.74	105

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
U-phase T2 tube driving resistance	94.38	97.44	92.34	96.39	130
INV drive board electrolytic capacitor	83.51	79.29	84.50	82.81	125
IO board SPS SELV24V rectifier diode D522	84.65	78.75	86.61	83.82	130
IO board SPS 15V electrolytic capacitor C578	89.22	83.79	90.79	88.15	105
24V electrolytic capacitor C581 of IO board SPS	94.12	88.83	95.52	93.21	105
IO board SPS SELV_ 24V electrolytic capacitor chamber 1 (C579-C581)	96.79	91.51	98.13	95.85	105
IO board 24V to 5V power supply chip U508	98.40	94.37	100.26	99.11	125
IO board 15V to 12VF power supply chip U509	87.87	82.21	89.31	86.48	125
IO board SELV_ 24V to+8V_ S power supply chip U545	80.42	74.52	82.33	79.51	125
IO board SPS 15V rectifier diode D520	97.25	92.05	98.66	96.04	125
IO board SPS U531	80.80	75.43	82.38	80.13	125
CNTL board CPLD	82.00	76.51	83.33	80.82	125
CNTL board 5V to 3V3 power supply chip (U106)	85.75	79.88	87.25	84.42	125
CNTL board pair DSP	92.60	87.16	93.96	91.43	125
CNTL board main DSP	93.68	87.95	95.14	92.43	125
IO board SPS electrolytic capacitor C565	88.07	83.67	89.61	87.65	125
IO board SPS U517	82.22	79.07	82.47	81.91	125
IO board RLY drive circuit Q506	87.36	85.02	89.18	89.50	130
I/O board V phase inverter current sensor shell temperature	78.38	73.18	80.23	77.92	85

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
Core temperature at air gap of SPS main transformer	88.09	85.83	89.84	90.29	115
RCD absorption cement resistance R433 and R436 of IO board SPS	104.65	98.58	107.51	104.87	130
IO board SPS main circuit MOS Q525	112.74	106.20	112.49	109.50	130
Air gap junction between coil and magnetic core of SPS CT of IO board	85.88	80.26	87.54	85.13	115
IO board SPS 24V rectifier diode D521	105.73	99.75	106.53	104.04	130
PIN4 of IO board RLY501	89.83	103.54	91.37	106.20	120
IO board LC filter capacitor 505 housing	81.14	76.89	80.97	79.11	105
IO board LC filter capacitor 523 shell temperature (near 522)	80.01	75.29	80.65	78.52	105
I/O board LC filter capacitor C513 and C514 cavity	81.38	78.16	81.99	81.40	105
I/O board inverter circuit sensor HCT501 shell temperature	79.85	76.51	81.44	80.82	125
IO board inverter current sensor JP503 through core copper bar	81.01	80.38	82.89	84.92	125
I/O board C530 and C529 cavities	78.88	74.64	80.73	79.54	110
Intermediate winding temperature of power frequency inductor CT502	89.40	102.20	92.42	107.01	130
Core temperature of power frequency inductor CT502	86.19	91.47	88.49	96.21	130
Case temperature of GFCI sensor CT501 on IO board	78.99	74.93	80.76	79.57	115
Intermediate winding of common mode inductor CT503	87.23	98.01	90.44	102.88	130

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
MPPT board C220	77.56	72.04	81.62	83.87	110
PV input film capacitance C155	76.93	70.65	80.02	78.97	105
W-phase DC+copper foil	86.29	90.30	88.59	93.80	130
MPPT board K106 copper foil	78.23	73.38	83.32	88.41	130
P122 terminal block at DC+	77.67	71.75	81.49	82.36	105
PV current sensor (HCT100)	79.39	73.62	83.34	84.48	125
MPPT board HCT105	78.91	73.12	82.73	83.98	125
P112 terminal block at DC	77.38	71.67	81.31	82.28	105
MPPT board K100 side back	76.92	70.63	79.86	78.31	85
PIN4 copper foil of RLY505 on bottom surface of IO board	82.60	85.92	84.51	90.49	130
Copper foil at the intermediate phase connection point between the common mode inductor on the BOTTOM side of the IO board and the V-phase output terminal	82.02	83.37	84.28	88.07	130
Annular temperature at the center above the IO board (relay)	78.60	73.97	80.30	78.63	85
Ambient temperature in front of upper cover	61.58	42.37	61.87	44.41	--
Ambient temperature under hanging plate	61.63	42.41	61.93	44.28	70
INV drive board U phase R431	94.27	89.74	91.13	89.20	115
W-phase inverter inductor lower surface copper wire	103.95	111.26	86.65	88.55	130
U-phase inverter module T2 tube wafer corresponding to the radiator hole	93.91	96.24	92.49	91.39	130
W-phase inverter module	99.13	106.99	93.84	92.50	130

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
clamping diode D5 at the corresponding radiator hole					
BUS N C505 copper foil	94.30	99.81	88.38	94.20	105
Copper foil between CT503 and capacitor	79.19	75.44	81.02	80.12	130
IO board SPS Q511	85.86	80.46	87.77	85.46	130
Side of BUSN-P501	89.00	87.47	83.82	83.13	105
MCU-U109 of CNTL board	82.20	76.39	83.81	81.02	105
K509 side	79.26	74.82	81.03	79.47	85
AC board G501	79.56	75.98	81.42	80.63	85
IO board SPS U537	80.74	75.33	82.32	79.99	125
J104 wire sheet	75.74	68.85	78.33	75.55	105
Electrolytic capacitor chamber 1 of upper left part of BUS capacitor board	77.82	71.54	80.72	77.39	105
BUS capacitor body (c116)	78.65	72.29	82.96	79.53	105
BUS capacitor body (c111)	78.65	72.08	82.88	78.47	105
DC+cable cover from BUS capacitor board to PSDR board	78.31	72.22	80.69	77.60	105
BOOST5-P119 cable cover	76.77	70.36	79.92	78.68	105
MPPT and PSDR connection DC wire cover P114	77.60	72.15	81.75	83.11	105
PV5+thread leather	77.70	72.50	81.99	84.92	105
Y capacitance at DC03+	75.83	68.85	78.73	76.66	110
IO board SPS U543	80.28	74.93	81.71	79.44	85
AC board Q504	86.86	83.78	88.55	88.21	130
AC board D506	89.72	87.93	91.93	91.74	130
AC board C521	83.43	81.03	85.19	85.31	105
AC board U501	82.85	79.13	84.69	85.55	125
IO board SPS L501	101.09	88.44	102.81	101.37	120
IO board SPS Q527	85.63	92.21	87.48	85.21	130
IO board SPS D519	98.12	88.92	102.50	99.85	130

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
IO board SPS C604	93.72	75.08	95.30	93.41	125
Communication optocou-pler (U512)	80.87	96.49	82.70	79.92	105
IO board SPS D510	102.83	88.07	104.66	101.90	130
IO board SPS ZD511	94.09	84.44	96.01	93.41	130
AC board Q501	86.65	77.45	88.39	88.91	130
CNTR board NTC (R970)	82.74	76.39	83.91	81.50	125
CNTR board U103	82.21	74.99	83.72	80.88	125
CNTR board U110	81.14	75.88	82.70	79.92	85
CNTR board X101	78.31	76.34	79.94	77.09	85
CNTR board C204 electro-lytic capacitor	81.94	73.62	83.48	80.93	85
Phase V wire sheet (AC side wire)	80.21	57.24	82.31	84.00	105
BOOST1 lower surface copper wire	68.72	55.58	87.33	100.55	135
SPS transformer bottom core	109.79	105.63	108.74	106.02	130
U phase terminal block of AC junction box	79.78	93.56	81.93	83.88	105
U-phase AC terminal strip in the chassis (AC con-nector)	82.83	52.31	85.80	96.77	105
SPS transformer TX502 skeleton	87.95	75.66	88.98	86.24	105
ISO relay	81.49	71.79	83.26	80.65	85
Y capacitor at AC side	77.68	74.47	79.32	76.33	115
PV side common mode in-ductance	80.37	74.51	82.29	79.45	125
Electrolytic capacitor at PV side	80.38	80.36	82.24	79.45	105
Drive transformer	86.15	72.39	87.94	85.37	125
Internal fan	78.25	52.87	78.36	77.62	80
External fan	70.19	60.48	69.31	53.32	80

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 230Va.c., (derating to 63.73kW)	850Vd.c., 230Va.c., 110kW	460Vd.c., 230Va.c., (derating to 65.50kW)	460Vd.c., 230Va.c., 110kW	
DC switch handle	66.03	50.61	67.22	55.18	70
Inverter backplane	66.89	55.38	65.87	50.94	100*
Heat sink	69.04	82.80	70.52	58.40	100*

Temperature T of winding:	R1 (Ω)	R2 (Ω)	T (°C)	allowed Tmax (°C)	insulation class
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Note(s):					

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
Ambient	60.0	37.0	60.0	37.0	--
BOOST1 transistor D100	79.02	73.38	73.44	61.01	130
BOOST1 transistor Q100	84.60	82.51	74.68	61.56	130
BUS film capacitor C165 and C166 cavity	80.78	79.67	78.83	74.37	105
Inverter Snubber capacitor C158 and C169 cavity	81.59	80.88	80.16	77.62	110
V-phase T1 tube driving resistance	87.21	88.62	87.91	88.14	130
W-phase BUSN copper foil	80.61	74.17	80.23	70.39	130
C152 INV side shell temperature	78.56	74.74	77.49	70.47	105
Inverter Snubber capacitor C167	80.06	77.60	79.37	75.13	110
DC SWITCH HOUSING	77.31	73.46	74.53	64.40	85
BOOST driver chip U104	80.63	78.22	76.31	68.18	125
Electrolytic capacitor C173 at BOOST side	77.16	71.31	74.61	63.97	105
U-phase T2 tube driving resistance	87.18	86.20	89.76	86.79	130

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
INV drive board electrolytic capacitor	80.92	74.84	80.35	70.93	125
IO board SPS SELV24V rectifier diode D522	83.75	76.79	81.98	71.29	130
IO board SPS 15V electro-lytic capacitor C578	87.70	81.07	86.50	76.10	105
24V electrolytic capacitor C581 of IO board SPS	91.16	84.69	90.08	79.90	105
IO board SPS SELV_ 24V electrolytic capacitor cham-ber 1 (C579-C581)	93.97	87.49	92.98	82.89	105
IO board 24V to 5V power supply chip U508	95.46	90.01	93.93	84.75	125
IO board 15V to 12VF power supply chip U509	86.83	79.81	85.52	74.80	125
IO board SELV_ 24V to+8V_ S power supply chip U545	79.54	72.58	77.83	67.19	125
IO board SPS 15V rectifier diode D520	94.55	87.79	93.72	83.19	125
IO board SPS U531	79.33	72.80	77.94	67.76	125
CNTL board CPLD	80.24	73.47	79.07	68.67	125
CNTL board 5V to 3V3 power supply chip (U106)	85.17	78.04	83.89	73.14	125
CNTL board pair DSP	90.86	84.06	89.74	79.28	125
CNTL board main DSP	92.26	85.38	91.07	80.45	125
IO board SPS electrolytic capacitor C565	85.75	79.36	84.43	74.36	125
IO board SPS U517	79.07	74.27	78.77	70.32	125
IO board RLY drive circuit Q506	85.15	80.83	83.90	75.99	130
I/O board V phase inverter current sensor shell tem-perature	76.75	70.47	75.43	65.36	85
Core temperature at air gap of SPS main transformer	85.80	81.59	84.55	76.77	115

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
RCD absorption cement resistance R433 and R436 of IO board SPS	107.44	100.37	105.48	94.41	130
IO board SPS main circuit MOS Q525	106.97	99.19	107.23	95.21	130
Air gap junction between coil and magnetic core of SPS CT of IO board	83.90	77.10	82.45	72.04	115
IO board SPS 24V rectifier diode D521	99.30	91.97	98.64	87.61	130
PIN4 of IO board RLY501	85.09	98.85	84.13	91.97	120
IO board LC filter capacitor 505 housing	77.57	71.51	77.61	68.14	105
IO board LC filter capacitor 523 shell temperature (near 522)	77.30	71.01	76.72	66.96	105
I/O board LC filter capacitor C513 and C514 cavity	77.93	72.29	77.46	68.30	105
I/O board inverter circuit sensor HCT501 shell temperature	77.76	73.45	76.59	68.48	125
IO board inverter current sensor JP503 through core copper bar	78.60	76.39	77.50	71.43	125
I/O board C530 and C529 cavities	77.06	71.69	75.70	66.41	110
Intermediate winding temperature of power frequency inductor CT502	85.32	94.77	83.86	90.14	130
Core temperature of power frequency inductor CT502	82.95	85.89	81.66	81.29	130
Case temperature of GFCI sensor CT501 on IO board	77.01	71.66	75.65	66.64	115
Intermediate winding of common mode inductor CT503	83.88	91.35	82.34	86.40	130
MPPT board C220	78.37	76.71	75.64	65.16	110
PV input film capacitance	77.27	72.43	74.52	63.84	105

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
C155					
W-phase DC+copper foil	85.87	89.26	84.57	85.74	130
MPPT board K106 copper foil	79.81	81.75	77.69	66.57	130
P122 terminal block at DC+	78.47	75.92	75.63	64.92	105
PV current sensor (HCT100)	80.11	77.90	76.89	66.71	125
MPPT board HCT105	79.66	77.52	76.43	66.27	125
P112 terminal block at DC	78.19	75.65	74.92	64.84	105
MPPT board K100 side back	77.06	71.62	74.46	63.68	85
PIN4 copper foil of RLY505 on bottom surface of IO board	79.85	81.37	79.09	76.53	130
Copper foil at the intermediate phase connection point between the common mode inductor on the BOTTOM side of the IO board and the V-phase output terminal	79.54	78.86	78.20	73.98	130
Annular temperature at the center above the IO board (relay)	76.59	70.54	75.31	65.45	85
Ambient temperature in front of upper cover	60.61	36.68	60.03	35.85	--
Ambient temperature under hanging plate	60.59	36.73	60.01	35.98	70
INV drive board U phase R431	87.82	81.10	91.24	81.43	115
W-phase inverter inductor lower surface copper wire	81.35	75.72	94.71	91.76	130
U-phase inverter module T2 tube wafer corresponding to the radiator hole	85.19	80.70	88.37	84.48	130
W-phase inverter module clamping diode D5 at the corresponding radiator hole	92.83	94.15	98.24	104.71	130

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
BUS N C505 copper foil	84.08	85.31	88.64	87.06	105
Copper foil between CT503 and capacitor	77.29	72.07	76.01	67.18	130
IO board SPS Q511	84.37	77.70	82.77	72.50	130
Side of BUSN-P501	80.54	75.50	84.30	76.20	105
MCU-U109 of CNTL board	80.00	72.89	78.70	67.75	105
K509 side	77.32	71.39	75.91	66.38	85
AC board G501	77.65	72.56	76.25	67.55	85
IO board SPS U537	79.28	72.68	77.92	67.69	125
J104 wire sheet	75.49	69.22	72.72	60.93	105
Electrolytic capacitor chamber 1 of upper left part of BUS capacitor board	76.68	70.20	75.13	64.50	105
BUS capacitor body (c116)	77.71	72.32	75.85	65.51	105
BUS capacitor body (c111)	77.37	71.62	75.91	65.62	105
DC+cable cover from BUS capacitor board to PSDR board	76.86	70.09	75.52	64.67	105
BOOST5-P119 cable cover	77.21	72.24	74.35	63.52	105
MPPT and PSDR connection DC wire cover P114	78.47	76.41	74.95	65.14	105
PV5+thread leather	78.69	78.15	75.12	65.70	105
Y capacitance at DC03+	75.74	69.93	73.06	61.53	110
IO board SPS U543	78.72	72.15	77.46	67.27	85
AC board Q504	84.66	79.84	83.47	74.99	130
AC board D506	87.70	82.77	85.60	77.77	130
AC board C521	81.15	76.55	80.05	71.65	105
AC board U501	80.58	76.87	79.26	72.00	125
IO board SPS L501	98.05	92.30	96.65	87.16	120
IO board SPS Q527	84.18	77.51	82.60	72.28	130
IO board SPS D519	98.06	91.26	94.55	83.89	130
IO board SPS C604	91.13	85.07	89.88	80.03	125

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
Communication optocou-pler (U512)	79.73	72.79	78.09	67.51	105
IO board SPS D510	101.12	93.58	99.40	87.92	130
IO board SPS ZD511	93.14	86.04	91.38	80.35	130
AC board Q501	84.46	80.37	83.19	75.46	130
CNTR board NTC (R970)	80.70	74.05	79.69	69.44	125
CNTR board U103	81.37	74.23	80.10	69.42	125
CNTR board U110	79.06	72.09	77.82	67.19	85
CNTR board X101	75.87	68.59	74.64	63.54	85
CNTR board C204 electro-lytic capacitor	79.69	72.86	78.43	67.94	85
Phase V wire sheet (AC side wire)	78.08	75.28	76.72	70.56	105
BOOST1 lower surface copper wire	88.63	98.57	66.04	49.58	135
SPS transformer bottom core	105.67	98.36	106.25	95.51	130
U phase terminal block of AC junction box	77.64	75.28	76.22	70.92	105
U-phase AC terminal strip in the chassis (AC con-nector)	79.76	87.23	78.32	85.21	105
SPS transformer TX502 skeleton	85.52	78.51	84.68	73.92	105
ISO relay	80.81	73.89	79.23	68.60	85
Y capacitor at AC side	76.14	68.89	74.84	64.13	115
PV side common mode in-ductance	79.44	72.47	77.77	67.08	125
Electrolytic capacitor at PV side	79.41	72.44	77.78	67.08	105
Drive transformer	84.76	77.83	83.22	72.61	125
Internal fan	77.49	70.64	75.63	64.95	80
External fan	67.27	44.88	67.83	45.13	80
DC switch handle	65.64	48.36	64.17	44.63	70

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	4600Vd.c., 253Va.c., (derating to 60.35kW)	460Vd.c., 253Va.c., 110kW	850Vd.c., 253Va.c., (derating to 60.77kW)	850Vd.c., 253Va.c., 110kW	
Inverter backplane	64.06	42.86	64.56	42.82	100*
Heat sink	78.25	69.33	75.48	65.24	100*

Temperature T of winding:	R_1 (Ω)	R_2 (Ω)	T (°C)	allowed T_{max} (°C)	insulation class
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Note(s):					

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
Ambient	30.0	60	55.0	60.0	--
BOOST1 transistor D100	56.58	85.04	58.91	80.74	130
BOOST1 transistor Q100	57.72	89.83	60.57	85.16	130
BUS film capacitor C165 and C166 cavity	76.40	83.83	60.50	80.88	105
Inverter Snubber capacitor C158 and C169 cavity	80.80	85.06	60.26	81.81	110
V-phase T1 tube driving resistance	93.67	92.21	64.86	87.24	130
W-phase BUSN copper foil	70.30	83.94	64.23	81.41	130
C152 INV side shell temperature	71.97	82.73	60.68	79.23	105
Inverter Snubber capacitor C167	78.23	84.67	60.42	80.65	110
DC SWITCH HOUSING	63.16	80.25	60.60	77.48	85
BOOST driver chip U104	66.93	84.11	61.43	81.09	125
Electrolytic capacitor	62.62	80.61	60.48	78.13	105

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
C173 at BOOST side					
U-phase T2 tube driving resistance	90.99	92.53	67.97	87.75	130
INV drive board electro-lytic capacitor	71.20	84.67	64.69	81.84	125
IO board SPS SELV24V rectifier diode D522	70.49	86.79	65.49	84.32	130
IO board SPS 15V elec-trolytic capacitor C578	75.30	90.97	69.84	88.03	105
24V electrolytic capaci-tor C581 of IO board SPS	79.10	95.71	74.64	93.02	105
IO board SPS SELV_ 24V electrolytic capaci-tor chamber 1 (C579-C581)	81.97	98.37	77.06	95.63	105
IO board 24V to 5V power supply chip U508	84.72	100.46	77.60	97.00	125
IO board 15V to 12VF power supply chip U509	74.06	89.48	68.66	86.59	125
IO board SELV_ 24V to+8V_ S power supply chip U545	66.34	82.49	63.11	80.20	125
IO board SPS 15V recti-fier diode D520	82.17	98.85	77.55	95.96	125
IO board SPS U531	67.30	82.54	63.20	80.12	125
CNTL board CPLD	68.32	83.49	64.30	81.07	125
CNTL board 5V to 3V3 power supply chip (U106)	72.52	87.43	68.38	85.10	125
CNTL board pair DSP	78.92	94.15	75.06	91.69	125
CNTL board main DSP	79.96	95.33	76.36	93.03	125
IO board SPS electro-lytic capacitor C565	73.82	89.79	69.24	87.27	125
IO board SPS U517	71.92	82.63	62.38	79.69	125
IO board RLY drive cir-cuit Q506	76.79	89.36	68.47	85.86	130

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
I/O board V phase inverter current sensor shell temperature	64.81	80.39	60.87	77.72	85
Core temperature at air gap of SPS main transformer	77.62	90.02	69.16	86.50	115
RCD absorption cement resistance R433 and R436 of IO board SPS	93.27	107.73	84.52	104.99	130
IO board SPS main circuit MOS Q525	94.67	112.71	83.71	109.06	130
Air gap junction between coil and magnetic core of SPS CT of IO board	71.31	87.71	67.47	85.39	115
IO board SPS 24V rectifier diode D521	86.82	106.75	80.52	104.08	130
PIN4 of IO board RLY501	103.41	91.56	61.63	84.08	120
IO board LC filter capacitor 505 housing	69.27	81.14	61.80	78.47	105
IO board LC filter capacitor 523 shell temperature (near 522)	67.30	80.81	61.58	78.21	105
I/O board LC filter capacitor C513 and C514 cavity	68.97	82.15	61.83	79.03	105
I/O board inverter circuit sensor HCT501 shell temperature	69.02	81.60	61.15	78.47	125
IO board inverter current sensor JP503 through core copper bar	73.27	83.05	61.05	79.17	125
I/O board C530 and C529 cavities	66.32	80.89	60.97	77.78	110
Intermediate winding temperature of power frequency inductor CT502	100.03	92.60	61.29	84.04	130
Core temperature of	86.26	88.67	61.54	82.46	130

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
power frequency inductor CT502					
Case temperature of GFCI sensor CT501 on IO board	66.77	80.92	61.02	77.77	115
Intermediate winding of common mode inductor CT503	95.06	90.62	60.81	82.56	130
MPPT board C220	63.81	81.79	60.69	78.65	110
PV input film capacitance C155	62.31	80.18	60.63	77.78	105
W-phase DC+copper foil	88.93	88.77	60.98	85.49	130
MPPT board K106 copper foil	65.06	83.49	60.78	79.63	130
P122 terminal block at DC+	63.32	81.65	60.98	78.73	105
PV current sensor (HCT100)	65.15	83.51	62.27	80.31	125
MPPT board HCT105	64.71	82.90	61.92	79.77	125
P112 terminal block at DC	63.24	81.47	60.65	78.45	105
MPPT board K100 side back	62.22	80.02	60.61	77.66	85
PIN4 copper foil of RLY505 on bottom surface of IO board	79.80	84.68	61.13	80.33	130
Copper foil at the intermediate phase connection point between the common mode inductor on the BOTTOM side of the IO board and the V-phase output terminal	77.15	84.45	60.74	79.53	130
Annular temperature at the center above the IO board (relay)	65.10	80.46	60.88	77.67	85
Ambient temperature in front of upper cover	28.78	62.00	55.44	62.32	--

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
Ambient temperature under hanging plate	28.99	62.05	55.27	62.18	70
INV drive board U phase R431	81.54	91.32	72.98	89.10	115
W-phase inverter inductor lower surface copper wire	109.07	86.82	65.27	83.65	130
U-phase inverter module T2 tube wafer corresponding to the radiator hole	88.18	92.68	61.39	86.24	130
W-phase inverter module clamping diode D5 at the corresponding radiator hole	114.71	94.03	60.14	92.57	130
BUS N C505 copper foil	97.65	88.56	64.26	83.80	105
Copper foil between CT503 and capacitor	67.51	81.18	60.84	77.97	130
IO board SPS Q511	71.78	87.94	67.87	85.53	130
Side of BUSN-P501	82.10	83.98	63.57	81.02	105
MCU-U109 of CNTL board	67.15	83.98	64.32	81.61	105
K509 side	66.20	81.19	61.30	78.35	85
AC board G501	67.89	81.58	61.17	78.45	85
IO board SPS U537	67.20	82.49	63.15	80.07	125
J104 wire sheet	59.04	78.48	60.14	76.18	105
Electrolytic capacitor chamber 1 of upper left part of BUS capacitor board	63.08	80.88	60.53	77.67	105
BUS capacitor body (c116)	63.60	83.13	60.28	78.82	105
BUS capacitor body (c111)	63.60	83.04	60.17	78.53	105
DC+cable cover from BUS capacitor board to PSDR board	63.65	80.85	60.68	77.90	105

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
BOOST5-P119 cable cover	61.95	80.08	60.53	77.84	105
MPPT and PSDR con-nection DC wire cover P114	63.64	81.92	60.57	78.80	105
PV5+thread leather	64.24	82.15	60.63	78.85	105
Y capacitance at DC03+	59.58	78.89	60.05	76.48	110
IO board SPS U543	66.88	81.87	62.67	79.45	85
AC board Q504	75.52	88.73	68.24	85.50	130
AC board D506	78.88	92.11	70.43	87.59	130
AC board C521	72.28	85.36	64.52	81.96	105
AC board U501	73.17	84.86	63.39	81.17	125
IO board SPS L501	86.95	103.02	80.93	99.84	120
IO board SPS Q527	71.59	87.65	67.51	85.21	130
IO board SPS D519	82.70	102.71	78.93	100.06	130
IO board SPS C604	79.65	95.49	73.99	92.45	125
Communication opto-coupler (U512)	66.76	82.86	63.38	80.42	105
IO board SPS D510	87.13	104.87	79.73	102.05	130
IO board SPS ZD511	79.50	96.20	74.03	93.61	130
AC board Q501	76.50	88.57	67.70	85.05	130
CNTR board NTC (R970)	69.27	84.08	64.85	81.62	125
CNTR board U103	68.82	83.89	65.07	81.59	125
CNTR board U110	66.54	82.86	63.54	80.51	85
CNTR board X101	62.82	80.10	61.16	77.74	85
CNTR board C204 elec-trolytic capacitor	67.32	83.65	63.98	81.24	85
Phase V wire sheet (AC side wire)	72.41	82.47	60.54	78.44	105
BOOST1 lower surface copper wire	45.60	87.51	58.88	83.98	135
SPS transformer bottom	94.77	108.95	84.65	106.32	130

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Clause	Requirement – Test	Result – Remark	Verdict

maximum temperature T of part/at:	Test condition				allowed Tmax (°C)
	850Vd.c., 210Va.c., 110kW	460Vd.c., 230Va.c., (derating to 62.42kW)	460Vd.c., 230Va.c., (Fan blocked, de-rating to 498W)	460Vd.c., 230Va.c., 110kW (blanket,derating to 49.02kW)	
core					
U phase terminal block of AC junction box	73.28	82.10	60.05	77.87	105
U-phase AC terminal strip in the chassis (AC connector)	95.34	85.98	57.77	78.25	105
SPS transformer TX502 skeleton	73.11	89.16	68.27	86.78	105
ISO relay	67.88	83.43	64.02	81.14	85
Y capacitor at AC side	63.27	79.48	60.68	76.95	115
PV side common mode inductance	66.26	82.45	62.80	80.09	125
Electrolytic capacitor at PV side	66.28	82.41	62.96	80.06	105
Drive transformer	71.86	88.12	67.74	85.77	125
Internal fan	64.04	78.52	61.58	78.25	80
External fan	39.28	69.45	57.86	74.99	80
DC switch handle	39.33	67.35	56.83	67.10	70
Inverter backplane	37.67	66.00	57.32	70.39	100
Heat sink	61.25	70.66	57.23	80.24	100

Temperature T of winding:	R_1 (Ω)	R_2 (Ω)	T (°C)	allowed T_{max} (°C)	insulation class
--	--	--	--	--	--
Note(s):					

4.4	TABLE: fault condition tests							
	test voltage (V) ..... :							—
	Ambient temperature (°C) ..... :							
No.	com-ponent No.	fault	test voltage (V)	test time	fuse No.	fuse cur-rent (A)	result	

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Clause	Requirement – Test	Result – Remark	Verdict

1.	PCE input	Reversed	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0KW AC Output: 230Vac /0A / 0kW FID: No output power feed into grid. No warning message. MT: N/A SD: ☐ Yes /☒ No GD: ☐ Yes /☒ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass/ ☐ Fail.
2.	PCE input	s-c	DC 850	10 min.	--	--	DC Input: 0Vdc / 23.5A / 0KW AC Output: 230Vac / 0A / 0kW FID: The PCE is not connected to the grid. MT: N/A SD: ☒ Yes /☐ No. GD: ☒ Yes /☐ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
3.	PCE input	Over-voltage	DC 1050	10 min.	--	--	DC Input: 1050Vdc / 2A / 2kW AC Output: 230Vac / 0A / 0kW FID: The input overvoltage warning is reported. MT: N/A SD: ☒ Yes /☐ No. GD: ☒ Yes /☐ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

4.	PCE input (only for multi-string)	Different input MPP1: low input MPP2: high input	DC 850	10 min.	--	--	DC Input: Low input:460Vdc / 21A / 10KW High input:850Vdc / 11A / 10KW AC Output: 230Vac / 25A / 17.5kW FID: Normal working. MT: N/A SD: ☐ Yes /☒ No GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
5.	PCE input (only for multi-string)	Same input (MPP1 & MPP2 from same power source)	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×2A / 22KW AC Output: 230Vac / 31A / 21.5kW FID: The independent mode cannot be connected to the grid, but the parallel mode can be connected to the grid successfully. MT: N/A SD: ☐ Yes /☐ No. GD: ☐ Yes /☐ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
6.	PCE output	Power over-feed (OCP & OTP function controlled by DSP / software is disable)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine is damaged after long operation. MT: N/A SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

7.	PCE output	Over-voltage (OVP function controlled by DSP / software is disable)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine is damaged after long operation. MT: N/A SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
8.	PCE output	s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
9.	PCE output	Phase sequence or polarity incorrect	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×10A / 110KW AC Output: 230Vac / 155A / 107kW FID: The inverter runs normally. MT: N/A SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

10.	PCE output	A-Phase mis-wiring grid connection	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
11.	PCE output	B-Phase mis-wiring grid connection	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
12.	PCE output	C-Phase mis-wiring grid connection	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

13.	PCE Cooling system failure	Fan locked	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×10A / 110KW AC Output: 230Vac / 155A / 107kW FID: Warning message 156 or 157 or 158 is reported. After warning message is reported, the machine still runs normally until over-temperature protection is triggered. Error message 40 is displayed. MT: ambient temperature 60℃, the SPS trasformer maximum temperature is 106.2 SD: ☐ Yes /☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes/☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
14.	PCE Cooling system failure	Blanket	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×10A / 110KW AC Output: 230Vac / 155A / 107kW FID: Normal working, the output power derating to 49kW. MT: ambient temperature 55℃, the IGBT maximum temperature is 92.1 SD: ☐ Yes /☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes/☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
MCU or DPS processer failure							

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Clause	Requirement – Test	Result – Remark	Verdict

15.	DSP failure	+1.2V power supply disable	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
16.	DSP failure	+3.3V power supply disable	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
17.	DSP failure	+5V power supply disable	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

18.	DSP failure	reset	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
19.	DSP failure	Misconnection with slave DSP	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
Loss of control & Function check fault							
20.	Watchdog failure	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

21.	IGBT PMW	Loss / failure (no power)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: If no grid-connected, the inverter bridge fault and relay check error are reported. MT: N/A SD: ☐ Yes /☐ No, GD: ☐ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
22.	IGBT PMW	Loss / failure (one bridge on always)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: If no grid-connection occurs, the inverter is abnormal and pass-through protection is triggered during grid-connection. MT: N/A SD: ☐ Yes /☐ No, GD: ☐ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
23.	IGBT PMW	Loss / failure (No driver)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

24.	PV/DC Voltage detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 500Vdc / 22A / 11kW AC Output: 230Vac / 15.5A / 10.7kW FID: Two PV channels are connected, one is normal, the other is short-connected with a 499K sampling resistance, which causes abnormal voltage sampling. The PV channel with abnormal sampling does not chase power. MT: N/A SD: ☐ Yes /☐ No, GD: ☐ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
25.	PV/DC current detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×10A / 110kW AC Output: 230Vac / 155A / 107kW FID: Error message 4 is displayed, that is, the DC current component is injected too high. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

26.	BUS Voltage detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
27.	Inverter current detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machines shut down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
28.	Inverter voltage detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Inverter voltage sampling loss, the machine directly off the grid; The inverter voltage sampling fault triggers overcurrent, and the relay check fault is reported. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

29.	Grid/AC current detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machines can't start. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
30.	Grid/AC voltage detector	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machines broken down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes/☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
31.	DC isolation device function check	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: When connected to the power grid, the machine is not connected to the grid. After about eight minutes, error message 38 is reported, that is, insulation impedance detection failed. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

32.	AC isolation device function check	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Not connected to the grid. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
33.	Relay / Contactor function check (K1 o-c)	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The network connection fails and relay check fails. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
34.	Relay / Contactor function check (K2 o-c)	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The network connection fails and relay check fails. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

35.	Relay / Contactor function check (K3 o-c)	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The network connection fails and relay check fails. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
36.	RCD/RCM function check (CT501)	Loss / failure	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×10A / 110kW AC Output: 230Vac / 155A / 107kW FID: Report GFCI error. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
37.	Ambient temperature detector	Loss / failure (s-c)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

38.	Ambient temperature detector	Loss / failure (o-c)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
39.	IGBT temperature detector	Loss / failure (s-c)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
40.	IGBT temperature detector	Loss / failure (o-c)	DC 850	30 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

41.	Heat-sink temperature detector	Loss / failure (s-c)	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Inverter cannot start up. No output power feed into grid. No components damage, no hazard. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
42.	Heat-sink temperature detector	Loss / failure(o-c)	DC 850	10 min.	--	--	DC Input: 850Vdc / 13×10A / 110kW AC Output: 230Vac / 155A / 107kW FID: The inverter shut down immediately. LED Off. No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
Components single fault condition and Functional insulation on PWB short circuit test							
43.	IGBT (IGBT D-S)	s-c	DC 850	60 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: BOOST IGBT short circuit, triggering BOOST overcurrent; INV IGBT short circuit, causing explosion. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☐ No, NCD: ☐ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

44.	DC input Bus capacitor (420μF)	s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Causing the machine to blow up, bus capacitor break down. MT: N/A MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
45.	DC input filter capacitor	s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine is not connected to the grid. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
46.	LC filter capacitor	s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine stopped immediately. Always report AC side current. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

47.	Power supply transformer (TX104)	Output 12V s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine goes straight off the grid. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
48.	Power supply transformer (TX108)	Output 5V s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine goes straight off the grid. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
PN Board							
49.	Drive up transformer	s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: Causing the machine to broke down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

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Clause	Requirement – Test	Result – Remark	Verdict

50.	SPS unit	Output s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
PCB Board							
51.	SPS unit	Output s-c	DC 850	10 min.	--	--	DC Input: 850Vdc / 0A / 0kW AC Output: 230Vac / 0A / 0kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

Legend (Special evaluation for PV Inverter abnormal test)

FID	Fault Indication	MT	Max. Temperature
SD	PCE Shut Down:	DG	Disconnection To Grid
RO	Recovered to Operate after removing the single fault setting	NCD	No comp. or parts damaged
NH	No hazards occurred	DST	Dielectric strength test
s-c	short-circuited	o-c	open-circuited
o-l	Over-load.		

Note(s):

Failures or faults may be short-circuits in the PCE, or to exposed conductive parts, earth faults, or short-circuit in the output circuits, failure in the control circuits, or blocking of a motor fed by power EE.

There shall be no emission of molten metal, burning insulation, or flaming or glowing particles FID the fire enclosure, and there shall be no charring, glowing, or flaming of the tissue paper or cheesecloth, or glowing or flaming of surgical cotton.

Faults protected by “UL certified current fuse only” shall be performed and repeated 3 times.

In case of components damaged other than fuse, the evaluation repeated 3 times.

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7.4 & 7.3.7.5	TABLE: clearance and creepage distance measurements					P
Clearance cl and creepage distance dcr at/of:	Uimp (Usys) [V]	U r.m.s. [V]	Required cl [mm]	cl [mm]	Required dcr [mm]	dcr [mm]
PCE unit						
PV supply circuit to metal chassis: BI (components)	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96x1.14 = 4.5	See below	11.0	See below
- at ON/OFF DC switch	--	--	--	>14.98	--	>14.98
AC mains circuit to metal chassis: BI (components)	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96x1.14 = 4.5	See below	11.0	See below
- at All PCB stand-off (between PCBs and metal chassis)	--	--	--	9.40	--	>11.0
Main power board:						
PV supply circuit / AC main circuit to communication port: RI	6771 (1100Vd.c.)	1100Vd.c. 230Vac	6.46*1.29= 7.4	See below	5.5*2= 11.0	See below
-at Optical couplers(U513~U515), (U510~U512), (U548, U550, U504)	--	--	--	8.0	Potted for type 1 protection 7.4	8.0
- at PCB trace Pin to Pin (U513~U515), (U510~U512), (U548, U550, U504) after potting)	--	--	--	11.1	--	11.1
-at TX502 between Pri. To sec.	--	--	--	12.02	--	12.02
INV and AC output circuit to PE: BI	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96*1.14= 4.5	See below	5.5	See below
-at PCB trace between UL- to PE	--	--	--	6.89	--	6.89
-at C519	--	--	--	7.15	--	7.15
-at PCB trace between RLY506 to PE	--	--	--	5.92	--	5.92
-at PCB trace between RLY502 to PE	--	--	--	5.85	--	5.85
-at PCB trace between CT502 to PE	--	--	--	6.01	--	6.01
-at C545~C548	--	--	--	6.89	--	6.89
MPPT board:						

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Clause	Requirement – Test	Result – Remark	Verdict

PV supply circuit to PE: BI	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96*1.14= 4.5	See below	5.5	See below
- at PV4- to PE	--	--	--	5.65	--	5.65
- at DC- to PE	--	--	--	5.58	--	5.58
EMC board PV side:						
PV supply circuit to PE: BI	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96*1.14= 4.5	See below	5.5	See below
-at PCB trace between J111 to PE(C151, C153)	--	--	--	8.61	--	8.61
Bus capacitor board:						
BUS+ and BUS- circuit to PE: BI	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96*1.14= 4.5	See below	5.5	See below
-at PCB trace between DC+ to PE	--	--	--	5.5	--	5.5
-at PCB trace between CT502 to PE	--	--	--	5.5	--	5.5
Boost & INV board:						
Main circuit to PE: BI	4771 (1100Vd.c.)	1100Vd.c. 230Vac	3.96*1.14= 4.5	See below	5.5	See below
-at PCB trace between D106 to PE	--	--	--	5.53	--	5.53
-at PCB trace between D105 to PE	--	--	--	5.53	--	5.53
-at PCB trace between COV106 to PE	--	--	--	5.62	--	5.62
-at PCB trace between Q109 to PE	--	--	--	5.71	--	5.71
-at PCB trace near BUSN	--	--	--	5.55	--	5.55
-at PCB trace between INV_V to PE	--	--	--	5.88	--	5.88
Isolation transformer in Aux. power circuits (TX502): RI	For detail requirement and measurement see transformer table.					
Circuits Definition:						
PV Circuits: DVC-C			AC mains/Grid Circuits: DVC-C			
Control Circuits: DVC-C			Communication and Display Circuits: DVC-A			
Protection Separation						

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Clause	Requirement – Test	Result – Remark	Verdict

PV Circuits to Accessible Parts Earthed: BI		AC mains/Grid Circuits to Accessible Parts Earthed: BI	
PV Circuits to Control Circuits: No separation		AC mains/Grid Circuits to Control Circuits: No separation	
Control Circuits to Communication Circuits: RI		Control Circuits to Display Circuit: RI	
Legend			
BI	Basic insulation	SI	Supplementary insulation
DI	Double insulation	RI	Reinforced insulation
FI	Functional insulation	O.V.C	Overvoltage category
PD	Pollution degree	MG	Insulating material group
PPI	Protection by Protective Impedance	DVC	Decision voltage classification
s-c	Shorted circuits	o-c	Opened circuits
Note(s): VMAX PV = 1100Vd.c., AC output voltage = 3N~ 400Va.c. PV supply circuits = O.V.C II, AC mains circuits = O.V.C. III. PD = PD2 (IP66), MG = IIIa, Altitude ⩽ 3000m (correction factor = 1.14) According to the degrees of protection provided by the enclosure is IP66, the pollution degree for the internal environment of PCE could be consider as PD2. To determine Creepage distances for reinforced insulation on PCBA, isolation chips (U513~U515), (U510~U512), U548, U550, U504 are potted with insulation materials, PD1 considered.			

7.3.7.8.3.2, 7.3.7.8.3.3	TABLE: distance through insulation measurement				P
distance through insulation di at/of:		U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
Opto-coupler for assessable parts to DC/AC live parts (RI)		DC 1100V	4240	0.2	≥ 0.4
Note(s): [1)] Certificated components.					

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Clause	Requirement – Test	Result – Remark	Verdict

7.5.1, 7.5.2 and 7.5.3	TABLE: electric strength measurements, impulse voltage test and partial discharge test				P
test voltage applied between:		test voltage [V]	impulse withstand voltage [V] 1.2/50 µs	partial discharge extinction voltage [V]	result
PV input to PE		DC 2120	6000	--	Pass
AC output to PE		DC 2120	6000	--	Pass
PV input to Communication port		DC 4240	8000	--	Pass
AC output to Communication port		DC 4240	8000	--	Pass
Legend					
BI	Basic insulation	SI	Supplementary insulation		
DI	Double insulation	RI	Reinforced insulation		
FI	Functional insulation	O.V.C	Overvoltage category		
Note(s):					

14	TABLE: list of critical components				P
Object/part No.	Manufacturer / Trademark	Type / model	Technical data	Standard	Mark(s) of conformity
--	--	--	--	--	--
Note(s): See list of critical components					

- End of Test Report -

Test Report issued under the responsibility of:

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TEST REPORT

IEC 62109-2

Safety of power converters for use in photovoltaic power systems – Part2: Particular requirements for inverters

Report Reference No. ..... :	CN22U9PH 001 attachment 1
Tested by (name + signature)..... :	See cover page
Witnessed by (name + signature) . :	N/A
Supervised by (name + signature). :	N/A
Approved by (name + signature) ... :	See cover page
Date of issue ..... :	See cover page
Testing Laboratory..... :	TÜV Rheinland (Shanghai) Co., Ltd.
Address ..... :	No.177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P. R. China
Testing location/ procedure ..... :	CBTL☐ TMP☐ WMT☐ SMT☐ RMT☐ CCATL☐
Testing location/ address ..... :	See cover page
Applicant's name ..... :	See cover page
Address ..... :	See cover page
Test specification:	
Standard ..... :	IEC/EN 62109-2: 2011
Test procedure..... :	TUV mark approval
Non-standard test method.....:	N/A
Test Report Form No. ..... :	IEC62109_2B
Test Report Form(s) Originator ..... :	LCIE - Laboratoire Central des Industries Electriques
Master TRF ..... :	Dated 2016-11

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description ..... :	See report CN22U9PH 001
Trade Mark ..... :	See report CN22U9PH 001
Manufacturer..... :	See report CN22U9PH 001
Model/Type reference ..... :	See report CN22U9PH 001
Ratings ..... :	See report CN22U9PH 001

Testing procedure and testing location:	
☒ **Testing Laboratory:**	
Testing location/ address ..... :	
☐ **Associated Test Laboratory:**	
Testing location/ address ..... :	
Tested by (name + signature)... :	See cover page
Approved by (+ signature)..... :	See cover page
☐ Testing procedure: TMP	
Tested by (name + signature)... :	
Approved by (+ signature)..... :	
Testing location/ address ..... :	
☐ Testing procedure: WMT	
Tested by (name + signature)... :	
Witnessed by (+ signature)..... :	
Approved by (+ signature)..... :	
Testing location/ address ..... :	
☐ Testing procedure: SMT	
Tested by (name + signature)... :	
Approved by (+ signature)..... :	
Supervised by (+ signature)..... :	
Testing location/ address ..... :	
☐ Testing procedure: RMT	
Tested by (name + signature)... :	
Approved by (+ signature)..... :	
Supervised by (+ signature)..... :	
Testing location/ address ..... :	

List of Attachments (including a total number of pages in each attachment):

See report CN22U9PH 001.

Summary of testing

Tests performed (name of test and test clause):	**Testing location:**
The critical tests were performed on this equipment include clauses 4.4.4.15.1, 4.4.4.15.2, 4.8.2.1, 4.8.3.5.2, 4.8.3.5.3 in scope of this standard.	The laboratory described on cover page.

Summary of compliance with National Differences

List of countries addressed: None.

☒ The product fulfils the requirements of IEC/EN 62109-2: 2011.

Copy of marking plate:

See report CN22U9PH 001.

Equipment mobility	:	☐ movable	☐ hand-held	
		☐ stationary	☒ fixed (Wall mounted)	
Connection to the mains	:	☐ pluggable equipment	☐ direct plug-in	
		☒ permanent connection	☐ for building-in	
Enviromental category	:	☒ outdoor	☐ indoor conditional	☐ indoor unconditional
Operating condition	:	☒ continuous	☐ short-time	☐ intermittent
Over voltage category mains	:	☐ OVC I	☐ OVC II	☒ OVC III ☐ OVC IV
Over voltage category PV	:	☐ OVC I	☒ OVC II	☐ OVC III ☐ OVC IV
Mains supply tolerance (%)	:	According to specified supply range		
Tested for IT power systems	:	☐ Yes	☒ No	
IT testing, phase-phase voltage (V)	:	N/A		
Class of equipment	:	☒ Class I	☐ Class II	
		☐ Class III	☐ Not classified	
Mass of equipment (kg)	:	See model list		
Pollution degree	:	☐ PD 1	☒ PD 2 (inside)	☒ PD 3 (outside)
IP protection class	:	IP66		

Possible test case verdicts:

- test case does not apply to the test object : N/A
- test object does meet the requirement : Pass (P)
- test object does not meet the requirement : Fail (F)

Testing:

Date of receipt of test items : See cover page

Date(s) of performance of tests : See cover page

General remarks:

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

Throughout this report a ☐ comma / ☒ **point** is used as the decimal separator.

Determination of the test results includes consideration of measurement uncertainty from the test equipment and methods.

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:	☐ Yes ☒ Not applicable

When differences exist; they shall be identified in the General product information section.

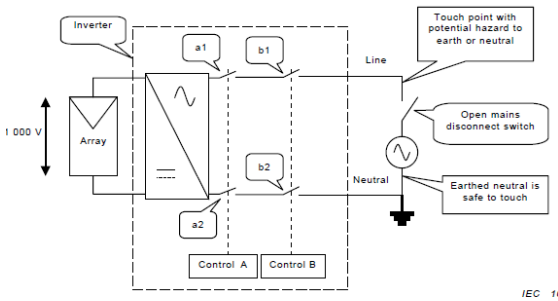
Name and address of factory (ies):	See report CN22U9PH 001

General product information:

See report CN22U9PH 001.

Throughout the test report following abbreviations may be used:

- input	i/p	- Test repeated, similar result(3 times)	TRSR
- output	o/p	- No indication of dielectric breakdown	NB
- short-circuited	s-c	- Cheesecloth remained intact	NC
- overloaded	o-l	- Tissue paper remained intact	NT
- open-circuited	o-c	- No hazards	NH
- normal conditions	N.C.	- The PCE can recover to operate automaticly after removing the abnormal condition	RO
- single fault conditions	SFC	- functional insulation	FI
- between parts of opposite polarity	BOP	- basic insulation	BI
- internal protection operated	IPO	- supplementary insulation	SI
- Component damage (list damaged component)	CD	- double insulation	DI
- No component damaged	NCD	- reinforced insulation	RI
Indicate used abbreviations (if any)			

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
4	General testing requirements *This clause of Part 1 is applicable with the following exceptions:*		P
4.4	Testing in SINGLE FAULT CONDITIONS		P
4.4.4	SINGLE FAULT CONDITIONS to be applied: *Additional subclauses:*	The PCE could detect and indicate the fault condition and disconnect from or not connect to the grid in case of single fault condition. Refer to the appended table 4.4 of IEC/EN 62109-1 test report CN22U9PH 001.	P
4.4.4.15	Fault-tolerance of protection for GRID-INTERACTIVE INVERTERS		P
4.4.4.15.1	Fault-tolerance of residual current monitoring		P
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		P
4.4.4.15.2.1	General		P
4.4.4.15.2.2	Design of insulation or separation  **Figure 20 – Example system discussed in Note 2 above**		P
4.4.4.15.2.3	Automatic checking of the disconnect means		P
4.4.4.16	Stand-alone inverters-load transfer test	Grid-connected PV Inverter.	N/A
4.4.4.17	Cooling system failure – Blanketing test		P
4.7	Electrical Ratings Tests *Additional subclauses:*	Refer to the appended table 4.7 of IEC/EN 62109-1 test report CN22U9PH 001.	P
4.7.3	Measurement requirements for AC output ports for stand-alone inverters	Grid-connected PV Inverter.	N/A
4.7.4	Stand-alone Inverter AC output voltage and frequency	Grid-connected PV Inverter.	N/A
4.7.4.1	General		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
4.7.4.2	Steady state output voltage at nominal DC input		N/A
4.7.4.3	Steady state output voltage across the DC input range		N/A
4.7.4.4	Load step response of the output voltage at nominal DC input		N/A
4.7.4.5	Steady state output frequency		N/A
4.7.5	Stand-alone inverter output voltage waveform		N/A
4.7.5.1	General		N/A
4.7.5.2	Sinusoidal output voltage waveform requirements		N/A
4.7.5.3	Non-sinusoidal output waveform requirements		N/A
4.7.5.3.1	General		N/A
4.7.5.3.2	Total harmonic distortion		N/A
4.7.5.3.3	Waveform slope		N/A
4.7.5.3.4	Peak voltage		N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms		N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads		N/A
4.8	Additional tests for grid-interactive inverters	See below.	P
4.8.1	General requirements regarding inverter isolation and array grounding	Non-isolated inverters for ungrounded arrays.	P
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	See below.	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays	Inverter indicates the insulation fault and stops to start.	P
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays	See above.	N/A
4.8.3	Array residual current detection		P
4.8.3.1	General		P
4.8.3.2	30mA touch current type test for isolated inverters	See appended table.	P
4.8.3.3	Fire hazard residual current type test for isolated inverters	See appended table.	N/A
4.8.3.4	Protection by application of RCD's		N/A
4.8.3.5	Protection by residual current monitoring		P
4.8.3.5.1	General	See below.	P

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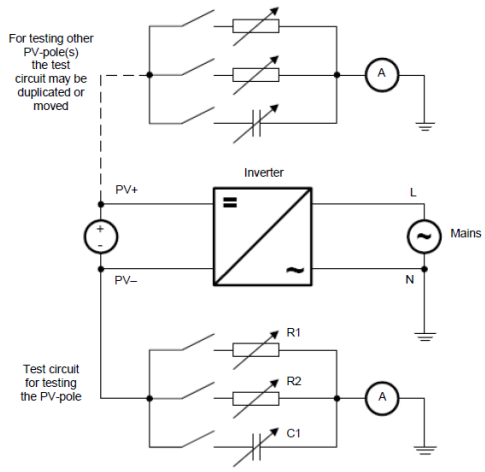
Clause	Requirement – Test	Result - Remark	Verdict
	Table 31 – Response time limits for sudden changes in residual current <table><tr><th>Residual current sudden change</th><th>Max. time to inverter disconnection from the mains</th></tr><tr><td>30 mA</td><td>0,3 s</td></tr><tr><td>60 mA</td><td>0,15 s</td></tr><tr><td>150 mA</td><td>0,04 s</td></tr></table>NOTE These values of residual current and time are based on the RCD standard IEC61008-1.	See appended table.	P
	 For the continuous residual current test, R1 establishes a baseline current just below the trip point, and R2 is switched in to cause the current to exceed the trip point. Capacitor C1 is not used. For the sudden change residual current test, C1 establishes a baseline current and R1 or R2 is switched in to cause the desired value of sudden change. The other resistor is not used. **Figure 21 – Example test circuit for residual current detection testing**	See appended table.	P
4.8.3.5.2	Test for detection of excessive continuous residual current	See appended table.	P
4.8.3.5.3	Test for detection of sudden changes in residual current	See appended table.	P
4.8.3.6	Systems located in closed electrical operating areas	Not specified to be located in closed electrical operating area.	N/A
5	Marking and documentation *This clause of Part 1 is applicable with the following exceptions:*	See report CN22U9PH 001.	P
5.1	Marking		P
5.1.4	Equipment ratings *Replacement:*		P

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Clause	Requirement – Test	Result - Remark	Verdict
5.2	Warning markings		P
5.2.2	Content for warning markings		P
5.2.2.6	Inverters for closed electrical operating areas		P
5.3	Documentation		P
5.3.2	Information related to installation *Additional subclauses:*		P
5.3.2.1	Ratings		P
5.3.2.2	Grid-interactive inverter setpoints	No adjustable setting available. Only the factory default values, however distribution network operator shall perform the adjustment.	N/A
5.3.2.3	Transformers and isolation	Transformer-less PCE.	N/A
5.3.2.4	Transformers required but not provided	Transformer-less PCE	N/A
5.3.2.5	PV modules for non-isolated inverters		P
5.3.2.6	Non-sinusoidal output waveform information	Grid-connection inverter.	N/A
5.3.2.7	Systems located in closed electrical operating areas	Not specified to be located in closed electrical operating area.	N/A
5.3.2.8	Stand- alone inverter output circuit bonding	Grid-connection inverter.	N/A
5.3.2.9	Protection by application of RCD's	Integrated RCM provided in inverter.	N/A
5.3.2.10	Remote indication of faults	The instructions are specified in section of "Connecting Communications Cables " in the user's manual.	P
5.3.2.11	External array insulation resistance measurement and response	Sub clause 4.8.2.1 compliance.	N/A
5.3.2.12	Array functional grounding information	No such requirements.	N/A
5.3.2.13	Stand-alone inverters for dedicated loads	Grid-connection inverter.	N/A
5.3.2.14	Identification of firmware version(s)	The firmware version disclosed by communication interface.	P
6	Environmental requirements and conditions *This clause of Part 1 is applicable.*		P

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Clause	Requirement – Test	Result - Remark	Verdict
7	Protection against electric shock and energy hazards *This clause of Part 1 is applicable except for the following additions:*	See report CN22U9PH 001.	P
7.3	Protection against electric shock *Additional subclauses:*		P
7.3.10	Additional requirements for stand-alone inverters	Grid-connection inverter	N/A
	Stand-alone inverter output circuit bonding		N/A
	Stand-alone inverter isolation and protection of DVC-A circuits		N/A
7.3.11	Functionally grounded arrays		N/A
8	Protection against mechanical hazards *This clause of Part 1 is applicable.*	See report CN22U9PH 001.	P
9	Protection against fire hazards *This clause of Part 1 is applicable with the following exceptions:*	See report CN22U9PH 001.	P
9.3	Short-circuit and overcurrent protection *Additional subclause:*		P
9.3.4	Inverter backfeed current onto the array		P
10	Protection against sonic pressure hazards *This clause of Part 1 is applicable*	See report CN22U9PH 001.	P
11	Protection against liquid hazards *This clause of Part 1 is applicable*	See report CN22U9PH 001.	P
12	Protection against chemical hazards *This clause of Part 1 is applicable*	See report CN22U9PH 001.	P
13	Physical requirements *This clause of Part 1 is applicable with the following exception:* *Additional subclause:*	See report CN22U9PH 001.	P
13.9	Fault indication		P
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and	Fault light is available for fault indication.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	b) an electrical or electronic indication that can be remotely accessed and used.	The error message also can be remotely accessed and used	P
14	Components *This clause of Part 1 is applicable*	See report CN22U9PH 001.	P

4.8.2.1	TABLE: Insulation resistance measurement				P
Conditions	Measurement [I.F. / N.O.]				Identification
	PV / DC Supply Voltage [Vd.c.]				
	200	450	850	950	
PV+ to PE: 180 [kΩ]	I.F.	I.F.	I.F.	I.F.	I.F.: Isolation Fault N.O.: Normal Operation
PV- to PE: 180 [kΩ]	I.F.	I.F.	I.F.	I.F.	
PV+ to PE: 200 [kΩ]	N.O.	N.O.	N.O.	N.O.	
PV- to PE: 200 [kΩ]	N.O.	N.O.	N.O.	N.O.	
PV+ to PE: 220 [kΩ]	N.O.	N.O.	N.O.	N.O.	
PV- to PE: 220 [kΩ]	N.O.	N.O.	N.O.	N.O.	
Note: Array Insulation Resistance Threshold Value R = 36.67 [kΩ] (Should be larger than R = $V_{MAX\,PV}$ / 30mA.) The accuracy of resistance measurement △R = 2 [kΩ] (the value declared by manufacturer)					

4.8.3.2, 4.8.3.3	TABLE: Touch current and fire hazard residual current measurement			N/A
Condition	PV power supply " + " → terminal A [mA]	PV power supply " - " →terminal A [mA]	Limit [mA]	Comments
--	--	--	--	--
Condition	PV power supply " + " → earthing [mA]	PV power supply " - " → earthing [mA]	Limit [mA]	Comments
--	--	--	--	--
Note: Using measurement circuit of IEC 60990 figure 4 for testing touch current. Using ammeter for testing fire hazard residual current.				

4.8.3.5.1	TABLE: Residual current monitoring test	P

Conditions	Steadily Residual current threshold value	
	Measurement [mA]	Limit [mA]
	U_N	
PV1+ to Neutral	797.5	1100
	797.5	1100
	797.5	1100
	797.5	1100
	797.5	1100
PV1- to Neutral	302.5	1100
	302.5	1100
	302.5	1100
	302.5	1100
	302.5	1100

Note:

1. 100% output power and Vmppmax input voltage
2. There are ten PV input terminals, but they are designed as same in software and hardware, using PV1+ and PV1- to represent the others.

4.8.3.5.1	TABLE: Residual current monitoring test	P

Conditions	Steadily Residual current threshold value	
	Measurement [ms]	Limit [ms]
	U_N	
PV1+ to Neutral	180	300
	180	300
	180	300
	180	300
	180	300
PV1- to Neutral	216.5	300
	216.5	300
	216.5	300
	216.5	300
	216.5	300

Note:

1. 100% output power and Vmppmax input voltage
2. There are ten PV input terminals, but they are designed as same in software and hardware, using PV1+ and PV1- to represent the others.

4.8.3.5.1	TABLE: Residual current monitoring test	P

Conditions	Trigger disconnection maximum time	
	Measurement [ms]	Limit [ms]
	U_N	
Sudden residual current ≥ 30mA		
PV1+ to Neutral	282.5	300
	282.5	300
	282.5	300
	282.5	300
	282.5	300
PV1- to Neutral	293.0	300
	293.0	300
	293.0	300
	293.0	300
	293.0	300
Sudden residual current ≥ 60mA		
PV1+ to Neutral	146.5	150
	146.5	150
	146.5	150
	146.5	150
	146.5	150
PV1- to Neutral	144.5	150
	144.5	150
	144.5	150
	144.5	150
	144.5	150
Sudden residual current ≥ 150mA		
PV1+ to Neutral	30	40
	30	40

	30	40
	30	40
	30	40
PV1- to Neutral	29.5	40
	29.5	40
	29.5	40
	29.5	40
	29.5	40

Note:

1. 100% output power and Vmppmax input voltage
2. There are ten PV input terminals, but they are designed as same in software and hardware, using PV1+ and PV1- to represent the others.

- End of test report -